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**WORK PLAN
for the
FOCUSED REMEDIAL INVESTIGATION/
FEASIBILITY STUDY FOR SITE 1
at the
ALLEGANY BALLISTICS LABORATORY
SUPERFUND SITE**

Prepared for

Atlantic Division
Naval Facilities Engineering Command
Norfolk, Virginia

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CONTENTS

| <u>Section</u> | <u>Page</u> |
|---|-------------|
| 1 Introduction | 1-1 |
| 2 Site Background and Physical Setting | 2-1 |
| Previous Investigations | 2-1 |
| Topography and Surface Hydrology | 2-6 |
| Regional Geology | 2-6 |
| Site Geology | 2-10 |
| Alluvium and Floodplain Deposits | 2-10 |
| Hydrogeology | 2-21 |
| Alluvial Aquifer | 2-22 |
| Bedrock Aquifer | 2-28 |
| 3 Initial Evaluation | 3-1 |
| Soil Contamination | 3-1 |
| VOCs Detected in Soils | 3-1 |
| SVOCs Detected in Soils | 3-19 |
| Explosives Detected in Soils | 3-22 |
| Metals Detected in Soils and Ash | 3-22 |
| Dioxin Detected in Ash Samples | 3-28 |
| TCLP Analysis of Composite Ash Samples | 3-28 |
| Groundwater Contamination | 3-28 |
| VOCs Detected in Groundwater | 3-31 |
| Explosive Compounds Detected in Groundwater | 3-35 |
| Inorganics Detected in Groundwater | 3-35 |
| Surface-Water and Sediment Contamination | 3-48 |
| 4 Work Plan Rationale and Justification | 4-1 |
| Hydrogeology and Geology | 4-3 |
| Groundwater Contamination | 4-3 |
| Soil Contamination | 4-3 |
| Surface Water and Sediment | 4-4 |
| 5 Technical Approach | 5-1 |
| Task 1: Work Plan | 5-1 |
| Task 2: Health and Safety Plan | 5-1 |
| Task 3: Sampling Plan | 5-2 |
| Task 4: Fracture Trace Analysis | 5-2 |
| Task 5: Well Installation | 5-2 |
| Task 6: DNAPL Investigation | 5-4 |

Section

Page

| | |
|---|------|
| Task 7: Well Testing | 5-6 |
| Task 8: Soil Sampling | 5-7 |
| Task 9: Soil Gas Sampling | 5-10 |
| Task 10: Groundwater Sampling | 5-10 |
| Task 11: Sediment Sampling | 5-11 |
| Task 12: Surface Water Sampling | 5-13 |
| Task 13: Laboratory Analysis | 5-13 |
| Task 14: Data Validation | 5-13 |
| Task 15: RI Report | 5-14 |
| Task 16: Baseline Risk Assessment | 5-14 |
| Task 17: Baseline Ecological Risk Assessment | 5-15 |
| Description of Areas for Ecological Consideration | 5-15 |
| Aquatic Site Reconnaissance Studies | 5-15 |
| Terrestrial Onsite Reconnaissance Studies | 5-16 |
| Contaminants of Concern | 5-16 |
| Exposure Assessment | 5-16 |
| Toxicity Assessment | 5-17 |
| Risk Characterization | 5-17 |
| Task 18: Feasibility Study Report | 5-17 |
| Task 19: Community Relations | 5-18 |
| Task 20: Proposed Plan | 5-18 |

| | | |
|---|----------------------------|-----|
| 6 | Project Schedule | 6-1 |
|---|----------------------------|-----|

TablesPage

| | | |
|------|---|------|
| 2-1 | Bedrock Stratigraphic Units of the Wills Mountain Anticlinorium Underlying the ABL Facility | 2-8 |
| 2-2 | Monitoring Well Construction Details and Borehole Lithologic Data | 2-11 |
| 2-3 | Summary of Slug Test Results at Wells Screened in the Alluvium | 2-23 |
| 2-4 | Summary of Water Level Measurements | 2-24 |
| 2-5 | Calculated Vertical Component of the Hydraulic Gradient at Paired Wells in the Alluvium and Bedrock | 2-29 |
| 2-6 | Water Levels at Selected Alluvium and Bedrock Monitoring Wells Adjacent to the North Branch Potomac River | 2-32 |
| 3-1 | VOC Analysis of Soil Samples by the Onsite Mobile Laboratory | 3-2 |
| 3-2 | Site 1 - Statistical Analysis of Analytical Data for Soil Samples Analyzed by the Onsite Mobile Laboratory | 3-7 |
| 3-3 | Site 1 Soil Sample Depths | 3-9 |
| 3-4 | VOCs Detected in Soil Samples Analyzed by Onsite Mobile Laboratory and Offsite Laboratory | 3-12 |
| 3-5 | Site 1 Statistical Analysis of VOCs Detected in Soil Samples Analyzed at Offsite Laboratory | 3-17 |
| 3-6 | Site 1 Semivolatile Organics Detected in Soil Samples | 3-20 |
| 3-7 | Site 1 - Explosives Analytical Data for Soil | 3-23 |
| 3-8 | Site 1 - Metals Analytical Data for Soil and Ash | 3-24 |
| 3-9 | Site 1 - Statistical Analysis of Metals Detected in Soils and Ash | 3-27 |
| 3-10 | Site 1 - Dioxin Analytical Data for Composite Ash Samples | 3-29 |
| 3-11 | Results of TCLP Analysis of Composite Ash Samples | 3-30 |
| 3-12 | Plant 1 - Comparison of Historical Analytical Results VOCS Detected in Groundwater | 3-36 |
| 3-13 | Volatile Compounds Detected in Sediment Samples at Site 1 | 3-54 |
| 3-14 | Explanation of EPA-Defined Qualifiers and Sample Number Suffixes for Analytical Data | 3-55 |

Figures

Page

| | | |
|------|---|------|
| 2-1 | Location Map Remedial Investigation | 2-2 |
| 2-2 | Plant 1 Features and Site Locations | 2-3 |
| 2-3 | Site 1—Waste Disposal Units | 2-5 |
| 2-4 | Approximate Location of Axis of The Wills Mountain Anticlinorium | 2-9 |
| 2-5 | Plant 1—Monitoring Well and Production Well Location Map | 2-13 |
| 2-6 | Plant 1—Cross Section Alignments | 2-14 |
| 2-7 | Cross-Section A-A | 2-15 |
| 2-8 | Cross-Section B-B | 2-16 |
| 2-9 | Cross-Section C-C | 2-17 |
| 2-10 | Plant 1—Bedrock Surface Elevations | 2-20 |
| 2-11 | Plant 1—Piezometric Surface of the Alluvial Aquifer | 2-27 |
| 2-12 | Plant 1—Piezometric Surface of the Bedrock Aquifer | 2-30 |
| 3-1 | Site 1—VOC Soil Sample Locations | 3-8 |
| 3-2 | TCE Detected in Soil Samples | 3-18 |
| 3-3 | Plant 1—Selected VOC Concentrations in the Alluvial Aquifer | 3-32 |
| 3-4 | Plant 1—Selected VOC Concentrations in the Bedrock Aquifer | 3-33 |
| 3-5 | Plant 1—Selected Metals Concentrations in the Alluvial Aquifer | 3-49 |
| 3-6 | Plant 1—Selected Metals Concentrations in the Bedrock Aquifer | 3-50 |
| 3-7 | Surface Water Sampling Locations | 3-51 |
| 3-8 | Sediment Sample Locations Collected During Remedial Investigation | 3-53 |
| 4-1 | Conceptual Site Model—Site 1 | 4-3 |
| 5-1 | Locations of Proposed Monitoring Wells | 5-3 |
| 5-2 | Seismic Refraction Survey Lines | 5-5 |
| 5-3 | Sample Locations | 5-8 |
| 5-4 | Sediment Sample Locations | 5-12 |
| 6-1 | Project Schedule | 6-2 |

Section 1 Introduction

This work plan describes the work necessary to perform a focused remedial investigation/feasibility study (RI/FS) for Site 1 included as part of the Allegany Ballistics Laboratory Superfund Site (ABL), located in Rocket Center, West Virginia. ABL was added to the National Priorities List (NPL) on May 31, 1994, and includes multiple sites. Future work conducted at sites other than Site 1 will be described in a separate work plan(s).

Included in this work plan is a description of the site background and physical setting in Section 2. Section 3 presents the initial evaluation of Site 1 based on the results of previous investigations. Section 4 discusses the work plan rationale and justification. Section 5 describes the individual RI/FS tasks and Section 6 presents the schedule for completion of these tasks.

WDCR814/016.WP5

Section 2

Site Background and Physical Setting

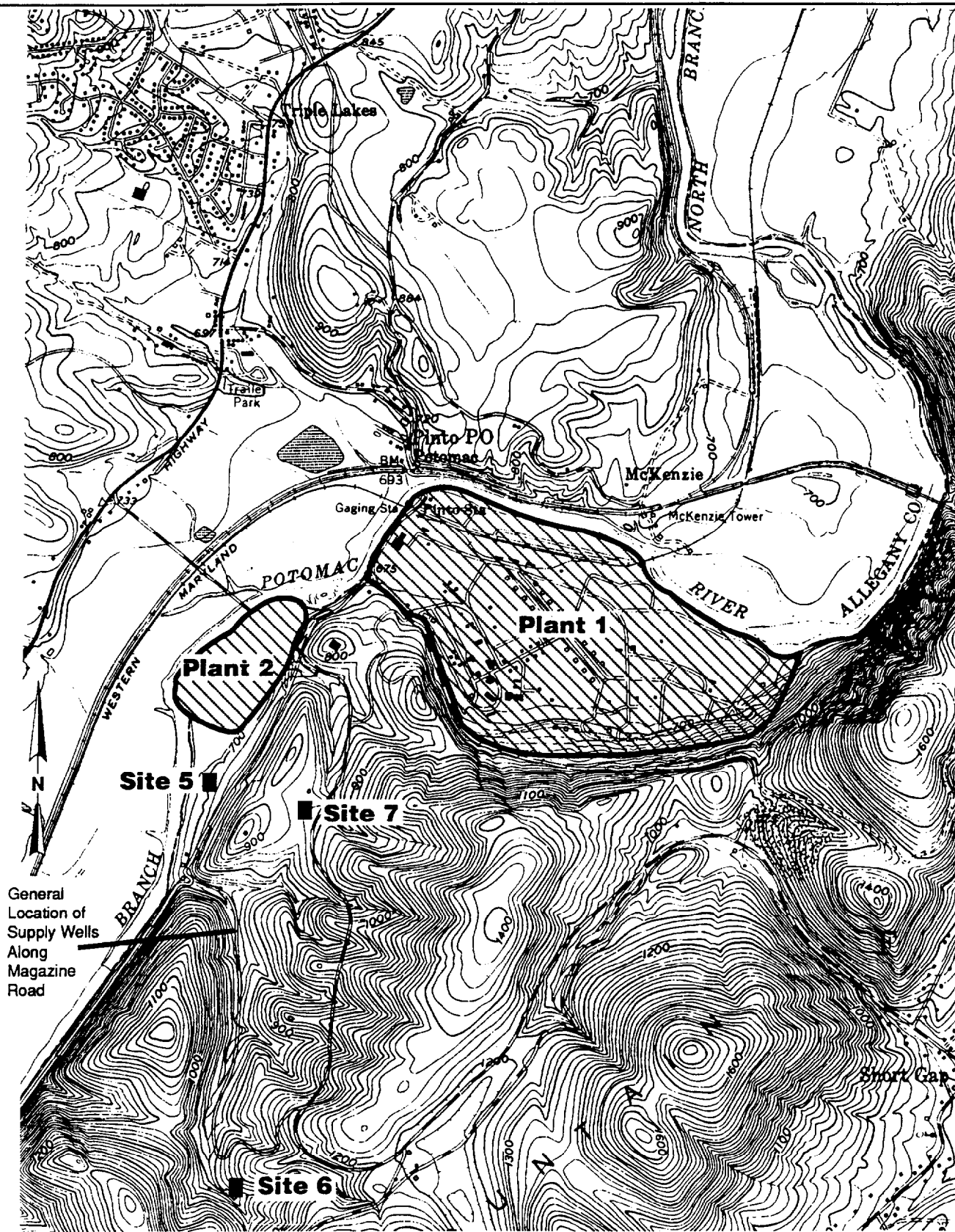
ABL is a government-owned, contractor-operated research, development, and production facility located in Mineral County, West Virginia. Since 1943, the facility has been used primarily for research, development, and testing of solid propellants and motors for ammunition, rockets, and armaments. The facility consists of two plants (Figures 2-1 and 2-2). Plant 1, occupying approximately 1,572 acres, is owned by the Navy and operated by the Aerospace Division of Hercules (Hercules). Approximately 400 acres at Plant 1 is in the floodplain of the North Branch Potomac River, with the remaining acreage on forested mountainous land. Site 1 is situated along the North Branch Potomac River on the northern end of Plant 1. Plant 2, a 56-acre area adjacent to Plant 1, is owned by Hercules.

Previous Investigations

A total of three previous investigations have been conducted at ABL including the Initial Assessment Study (IAS), the Confirmation Study, and the Remedial Investigation. The IAS was completed in 1983 under the Navy Assessment and Control of Installation Pollutants Program (NACIP). As promulgated by OPNAVNOTE 6240 and Marine Corps Order 6280.1, the purpose of the NACIP is to systematically identify, assess, and control contamination from past operations involving hazardous materials. The focus of the IAS was to identify sites where hazardous materials were handled and to assess the need for further evaluation of these site areas.

The IAS conducted at ABL was designed to (1) identify areas of contamination from past handling, storage, and disposal of hazardous substances; (2) assess the potential impact of the contamination on human health and the environment; and (3) recommend remedial measures that are appropriate to the area(s) of contamination. On the basis of information from historical records, aerial photographs, field inspections, and personnel interviews, nine sites were identified for further evaluation. The IAS concluded that these sites did not pose an immediate threat; however, results of the IAS showed the need for a confirmation study at seven of the nine sites to assess the potential impacts on human health and the environment of suspected contaminants. The seven sites selected for further evaluation included:

- Site 1: Northern Riverside Waste Disposal Area
- Site 2: Previous Burning Ground (1942-1949)
- Site 3: Previous Burning Ground (1950-1958)
- Site 4: Spent X-Ray Developing Solution Disposal Site
- Site 5: Inert (nonordnance) Landfill
- Site 6: Sensitivity Test Area Surface Water Impoundment
- Site 7: Beryllium Landfill

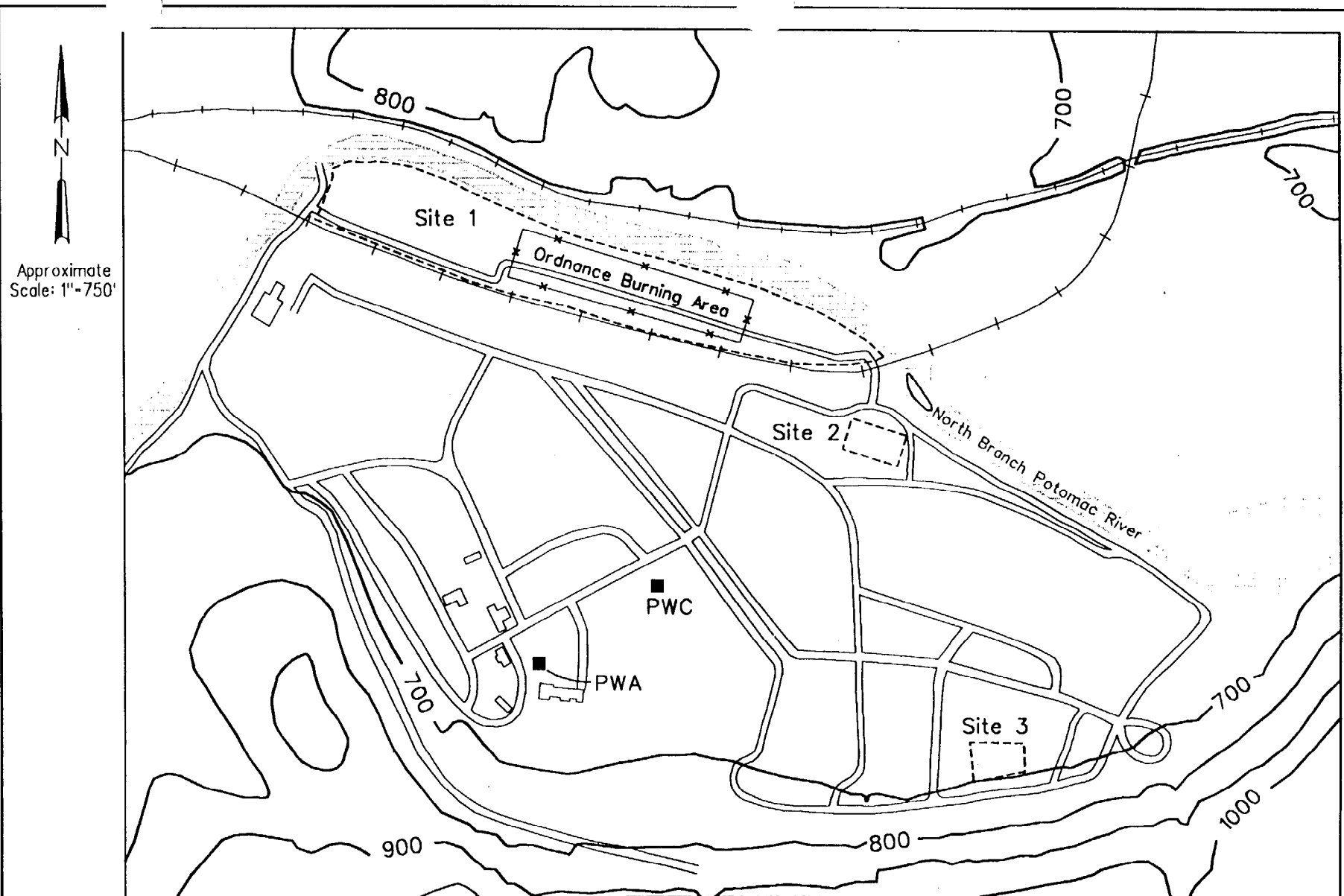


Source: USGS 7.5 minute Cresaptown, WV-MD quadrangle map.

0 1000 2000
Scale in Feet

Figure 2-1
LOCATION MAP
Remedial Investigation
Allegany Ballistics Laboratory





LEGEND

- | | |
|-------------------------------|---|
| ■ Production Well | — 900 — Topographic Contour (Elevation in ft above msl) |
| □ Approximate Site Boundaries | —+—+—+ Railroad |
| | —x—x— Fence |

Figure 2-2
PLANT 1 FEATURES
AND SITE LOCATIONS
 Allegany Ballistics Laboratory



Following the IAS results and in accordance with the NACIP, a Confirmation Study was initiated in June 1984 and completed in August 1987. The confirmation study focused on identifying the existence, concentration, and extent of contamination at the seven sites recommended for further investigation in the IAS, along with production well PWA located on Plant 1. Field activities conducted under the Confirmation Study included installing monitoring wells; collecting and analyzing samples of groundwater, surface water, sediment, and soil gas; performing a geophysical survey inside the burn area at Site 1; and conducting a pump test at well PWA.

As a result of the Superfund Amendments and Reauthorization Act of October 1986 (SARA), the Navy changed its NACIP terminology and scope under the Installation and Restoration Program (IRP) to follow the rules, regulations, and guidelines, and criteria established by EPA for the Superfund program. For this reason, the results of the Confirmation Study are documented in the Interim Remedial Investigation (Interim RI) Report, October 1989. The Interim RI Report recommended further remedial investigation activities for six of the seven sites, with minimal activity suggested for sites 4A and 4B, the Spent X-Ray Developing Solutions Disposal Site. The report also recommended that activities be discontinued at site 6, the Sensitivity Test Area Surface Water Impoundment.

Following the recommendations of the Interim RI Report and in accordance with the Navy's changed IRP policy, Hercules contracted CH2M HILL to conduct a Remedial Investigation (RI) following EPA's RI/FS format under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) described in the EPA document *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (October 1988 Interim Final). Although Hercules contracted CH2M HILL to conduct the RI, the Navy funded the effort and provided input throughout.

The RI included a number of investigation activities. Historical aerial photographs were reviewed in order to determine the type and location of waste disposal units at sites 1, 2, and 3. Figure 2-3 shows the general location of the waste disposal units. A focused facility audit was conducted to determine possible sources of VOC contamination at sites 1, 2, 3, and PWA. Field activities included installation of 17 monitoring wells, soil sampling, groundwater sampling, surface water and sediment sampling, well testing, a fracture orientation investigation, a down-hole camera survey, and water level measurements.

A variety of analytical methods and techniques were employed during the RI. An onsite mobile laboratory was used to analyze soil samples for select VOCs and X-ray fluorescence (XRF) was used to screen soil samples for metals. An offsite laboratory was used to perform all other analyses. Soil samples were analyzed for VOCs, semivolatile compounds (SVOCs), metals, and explosives. Ash samples collected at Site 1 were analyzed for metals and dioxin, and the toxicity characteristic leaching procedure (TCLP) for metals was performed. Groundwater samples were analyzed for VOCs, explosives, and metals. Surface water and sediment samples were analyzed for VOCs and metals.

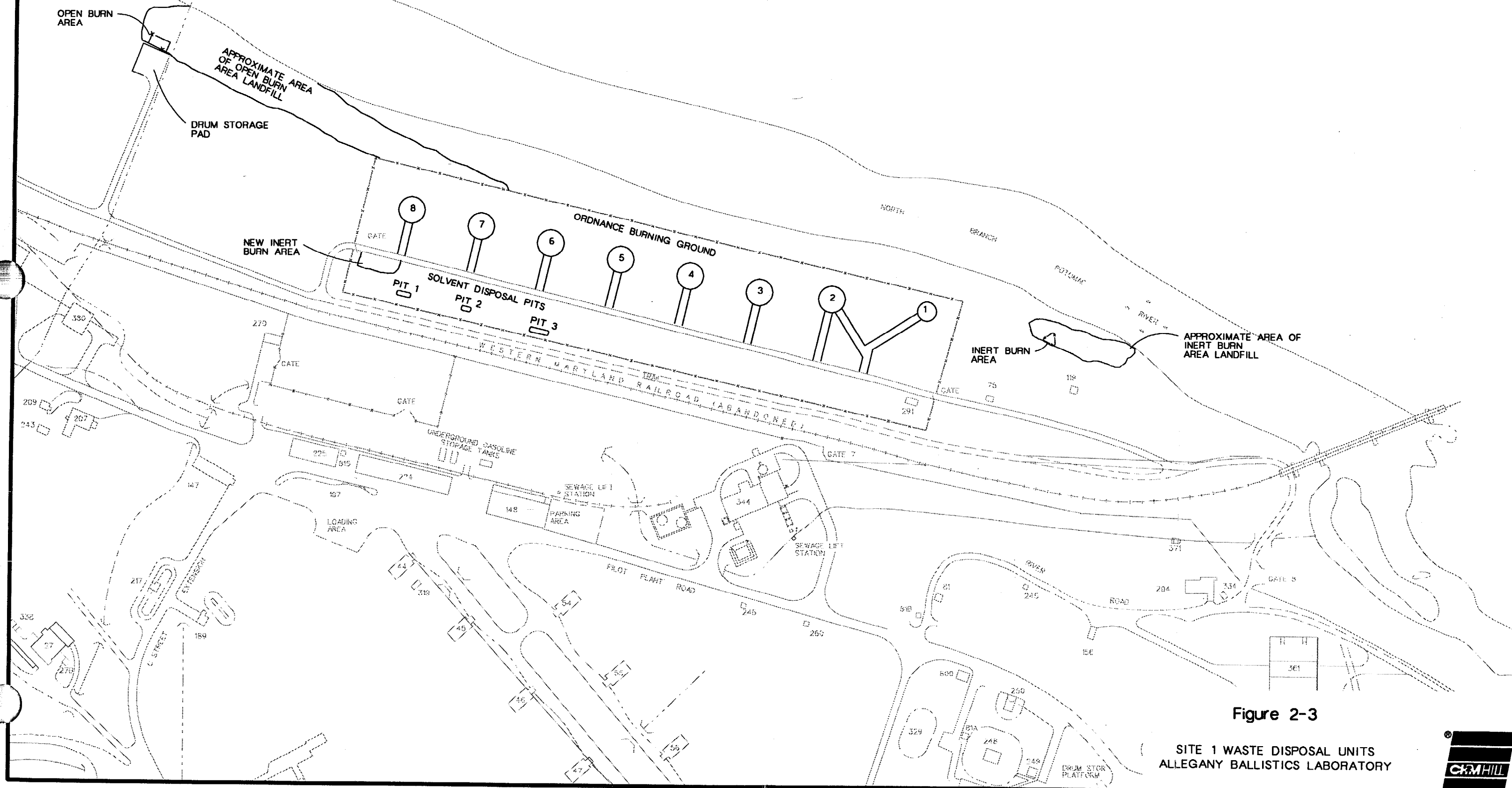
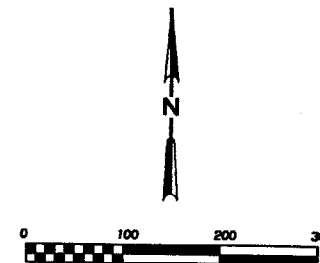


Figure 2-3

SITE 1 WASTE DISPOSAL UNITS
ALLEGANY BALLISTICS LABORATORY



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The Draft RI Report was completed in October 1992. At Site 1, the Draft RI Report recommended further investigation of the river along Site 1 to determine whether the river acts as an hydraulic barrier preventing VOC contamination detected in bedrock groundwater from flowing beneath the river. Also, the collection of additional surface water and sediment samples was recommended to determine the extent of contamination detected in the river alongside Site 1.

The following discussions of topography and surface hydrology, regional geology, site geology, and hydrogeology are based on information provided in the IAS, Interim RI Report, Draft RI Report, and performance of the RI. Because Site 1 is located on Plant 1 and to gain a more comprehensive understanding of the conceptual model at Site 1, these discussions will focus on Plant 1, making specific references to Site 1 where appropriate.

Topography and Surface Hydrology

Site 1 is located along the North Branch Potomac River at the northern end of Plant 1. Plant 1 is located in its floodplain and is essentially flat, with the elevation ranging from about 665 feet above mean sea level (msl) at the top of the bank of the river along Site 1, to about 700 feet msl along the southern border.

The predominant hydrologic feature of the ABL facility is the North Branch Potomac River, which borders the western and northern sides of the facility. The elevation of the river ranges from about 655 feet msl in the vicinity of Site 5 to about 645 feet msl at the eastern end of the Plant 1 area. The discharge of the river at the Pinto gaging station (for which there are records from 1938 through 1981) averaged about 850 cubic feet per second. Stormwater runoff from Plant 1 collects in intermittent drainage ditches and flows to the river.

Regional Geology

ABL is located in the Valley and Ridge Physiographic Province near its' western boundary with the Allegheny Plateau Province. The transition between these provinces is referred to as the Allegheny Structural Front (Schultz, 1989). The Valley and Ridge Physiographic Province is underlain by sedimentary rocks folded and faulted during the late Paleozoic Era. The linear belts of ridges and valleys that characterize the province result from differential erosion of the various rock types. In general, more-resistant sandstones underlie, ridges whereas less-resistant shales and soluble limestones underlie lowlands.

The most significant physiographic feature in the vicinity of ABL is Knobly Mountain, which flanks Plant 1 to the south and east. Plant 1 is located on the floodplain of the North Branch Potomac River at a point where the river has cut into the base of Knobly Mountain. Knobly Mountain is the surface expression of a portion of the Wills Mountain

anticlinorium the anticlinal axis of which trends approximately N30°E and plunges to the southwest (Eddy, 1964).

Shales, limestones, and sandstones of Silurian and Devonian age underlie the portion of the Wills Mountain anticlinorium passing through ABL. Table 2-1 presents a general description of the stratigraphic units of the Silurian and Devonian bedrock underlying ABL. Geological maps estimating the distribution of the various rock types in the region surrounding ABL have been prepared by Dyott (1956) and Eddy (1964).

The Wills Mountain anticlinorium is asymmetrical. To the southeast of the anticlinal axis, the strata dip relatively gently to the southeast at approximately 30 degrees (Dyott, 1956). The strata on the northwest limb of the anticline are generally vertical to slightly overturned (Schultz, 1989). Across the river to the north of Plant 1 at Pinto, Maryland, outcrops reveal vertical to overturned strata containing numerous small-scale folding and faulting features (Schultz, 1989).

Figure 2-4 shows the approximate location of the Wills Mountain anticlinorium axis. The western half of Plant 1 and most of Site 1 is located on the vertical or overturned northwest limb of the anticlinorium; the dips of bedding planes in the bedrock underlying these portions of ABL are expected to be near vertical. Strata underlying the eastern half of Plant 1 are part of the southeast limb of the anticlinorium, and therefore, bedding planes dip gently to the southeast.

The measurement of the orientation of 96 fracture planes in the vicinity of ABL during the RI revealed two principal fracture sets:

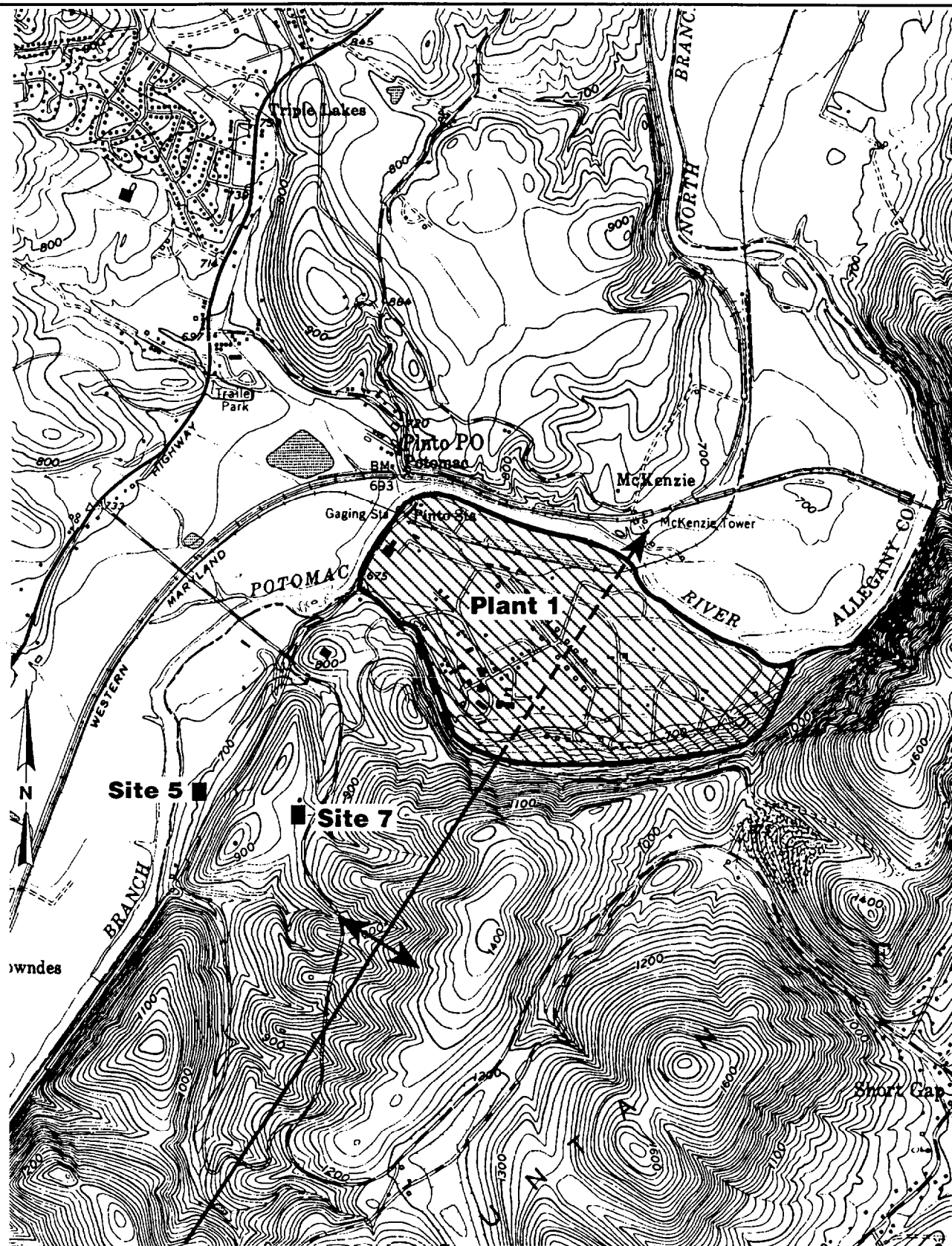
| | <u>Average Strike</u> | <u>Frequency</u> |
|----------------|---------------------------|------------------|
| Fracture Set 1 | N26°E | 44% |
| Fracture Set 2 | N39°W | 29% |

Fracture Set 1 was the most common fracture pattern, constituting 44 percent of the fractures measured. This fracture set is parallel to the Wills Mountain anticlinorium and the structural trend of the Appalachian folds in the region. The fracture set was prevalent in most lithologies. Fracture set 2 is oblique to the Appalachian structural trend.

A regional study (Kribbs, 1982) of fractures in the Valley and Ridge Physiographic Province in portions of Mineral and Hampshire counties, West Virginia, identified 5 principal average fracture trends: N37°W, N53°E, N60°W, N30°E, and a set trending east-west. Kribbs identified the fracture sets trending N37°W and N30°E, as the most prevalent fracture trends, particularly in Silurian strata (Kribbs, 1982). Kribbs' fracture sets correspond well to fracture sets 1 and 2 identified during the RI.

**Table 2-1
BEDROCK STRATIGRAPHIC UNITS OF THE WILLS MOUNTAIN ANTICLINORIUM
UNDERLYING THE ABL FACILITY**

| System | Formation | Description | Approximate Thickness (ft) |
|---|---|--|----------------------------|
| Devonian | Marcellus Shale | Shale, thinly laminated to fissile, black or grayish black, pyritic. | 250 ¹ |
| | Needmore Shale | Shale, usually calcareous, non fissile, medium dark gray. | 100 ¹ |
| | Oriskany Formation | Sandstone, calcareous and cherty at bottom, siliceous at top, coarse-grained, bluish. | 180 to 200 ² |
| | Helderberg Group | Limestone, medium to dark gray, with interbeds of crystalline limestone and dark gray chert nodules. Prominent basal unit called the Keyser Formation. | 467 ¹ |
| Silurian | Tonoloway Formation | Argillaceous dolomitic limestone with interbedded calcareous shale, dark gray. | 625 ³ |
| | Wills Creek Formation | Calcareous shale and interbedded argillaceous limestone, medium to dark gray. Williamsport Sandstone Formation at base (21 feet thick ³), consisting of an upper and lower sandstone unit separated by shale or limestone. | 467 ³ |
| | Mifflintown Formation: McKenzie Member | Shale, calcareous, medium gray, and interbedded argillaceous limestone. | 241.5 ³ |
| | Rochester Member | Shale, fissile, medium to dark gray, interbedded with fossiliferous limestone. | 28 ³ |
| | Keefer Member | Sandstone, fine-grained, dark gray, overlain by a thin seam of oolitic hematite. | 7.5 ³ |
| | Rose Hill Formation | Shale interbedded with lesser amounts of sandstone; a few beds of highly fossiliferous dolomitic limestone at the top of the formation. Greenish-gray to moderate brown. | 420 ² |
| | | | |
| Sources for Lithologic Descriptions: Clark (1967), Dyott (1956), Eddy (1964), and Helfrich (1975). Sources for Thicknesses: ¹ Eddy (1964), ² Dyott (1956), ³ Helfrich (1975). | | | |



Basemap: USGS 7.5 minute Cresaptown, WV-MD quadrangle map.

LEGEND



Approximate location
of Anticinal Axis
(from Eddy, 1964)

0 1000 2000

Scale in Feet

Figure 2-4
APPROXIMATE LOCATION OF AXIS OF
THE WILLS MOUNTAIN ANTICLINORIUM
Allegany Ballistics Laboratory



Site Geology

Information on the geology of Plant 1 was obtained during the installation of monitoring wells during the RI and Interim RI. Borehole logs recorded during alluvial drilling at ten well locations provided the lithologic characterization of the alluvium. Geologic information on the bedrock underlying ABL was obtained from samples of air-rotary drill cuttings collected during bedrock drilling at 12 locations. Additional geologic information was obtained from the logs of 25 monitoring well borings completed during the Interim RI.

Table 2-2 summarizes the stratigraphic data and the construction details of the monitoring wells obtained from drilling during the RI and reported in the Interim RI. Figure 2-5 shows monitoring well locations at Plant 1. Boring logs, well completion diagrams, and bedrock descriptions prepared during the RI and confirmation study are included in appendices in both the RI and Interim RI reports.

Three interpretative cross-sections of the materials underlying Plant 1 have been prepared to assist in formulating a conceptual model of the site geology.¹ Figure 2-6 shows the locations of the cross section alignments. Figures 2-7, 2-8, and 2-9 present the cross sections.

Alluvium and Floodplain Deposits

The cross sections illustrate that the unconsolidated deposits overlying bedrock at Plant 1 consist of two basic layers of earth. In descending order, they are:

- A silty clay layer, considered floodplain deposits of the North Branch Potomac River.
- A sand and gravel layer containing pebbles and cobbles, with variable but typically significant amounts of clay and silt. This layer is presumably alluvium deposited by the North Branch Potomac River.

¹In several instances where monitoring wells drilled during the RI are adjacent to wells installed during previous investigations, borehole logs from the new wells showed significant differences in such features as depth to bedrock and depth to top of the alluvial layer. For example, it was reported (Roy F. Weston, Inc., 1989) that bedrock was not encountered above a depth of 40 feet at Well 1GW5. However, during the RI, bedrock was encountered at a depth of approximately 25 feet Well 1GW14, which is located only about 20 feet from Well 1GW5, and at nearly the same surface elevation. In these instances, the data collected during the RI was considered more reliable, and was afforded more weight in the preparation of the cross sections. CH2M HILL feels this is justified because the RI included the collection of soil samples for lithologic characterization, whereas previous investigations relied almost exclusively on the description of drill cuttings.

Table
MONITORING WELL CONSTRUCTION DETAILS AND BOREHOLE LITHOLOGIC DATA¹

Page 1 of 2

| Well | Ground Elevation ² (ft. MSL) | Casing Elevation ² (ft. MSL) | Depth of Boring (ft) | Screen Top | | Screen Bottom | | Screened Unit ² | Surface Casing | | Top of Clayey Gravel Alluvium | | Top of Bedrock | |
|-------|--|--|-------------------------|---------------|------------------------|---------------|------------------------|----------------------------|----------------|------------------------|-------------------------------|------------------------|----------------|------------------------|
| | | | | Depth (ft) | Elevation (ft. MSL) | Depth (ft) | Elevation (ft. MSL) | | Depth (ft) | Elevation (ft. MSL) | Depth (ft) | Elevation (ft. MSL) | Depth (ft) | Elevation (ft. MSL) |
| GGW1 | 668.79 | 671.65 | 23 | 18 | 650.79 | 23 | 645.79 | A | NA | NA | NA | NA | NA | NA |
| GGW2 | 669.01 | 672.07 | 84.5 | 70 | 599.01 | 80 | 589.01 | B | 31 | 638.01 | 8 | 661.01 | 23.5 | 645.51 |
| GGW3 | 667.53 | 670.57 | 22 | 12 | 655.53 | 22 | 645.53 | A | NA | NA | NA | NA | NA | NA |
| GGW4 | 667.51 | 670.66 | 82 | 70 | 597.51 | 80 | 587.51 | B | 24 | 643.51 | 8 | 659.51 | 22 | 645.51 |
| GGW5 | 663.92 | 666.59 | 26 | 15.5 | 648.42 | 25.5 | 638.42 | A | NA | NA | NA | NA | NA | NA |
| GGW6 | 663.93 | 666.75 | 81 | 70 | 593.93 | 80 | 583.93 | B | 33 | 630.93 | 13 | 650.93 | 28.5 | 635.43 |
| GGW7 | 660.36 | 663.21 | 23 | 13 | 647.36 | 23 | 637.36 | A | NA | NA | NA | NA | NA | NA |
| GGW8 | 660.27 | 663.21 | 80 | 70 | 590.27 | 80 | 580.27 | B | 30 | 630.27 | 10 | 650.27 | 24 | 636.27 |
| 1GW1 | 667.62 | 670.09 | 40 | 10 | 657.62 | 40 | 627.62 | A,B | NA | NA | 9.5 | 658.12 | 24 | 643.62 |
| 1GW2 | 664.18 | 666.79 | 40 | 10 | 654.18 | 40 | 624.18 | B | 29 | 635.18 | 13 | 651.18 | 26 | 638.18 |
| 1GW3 | 665.95 | 668.25 | 40 | 10 | 655.95 | 40 | 625.95 | A,B | 24 | 641.95 | 13 | 652.95 | 29 | 636.95 |
| 1GW4 | 667.85 | 670.51 | 40 | 10 | 657.85 | 40 | 627.85 | B | 29 | 638.85 | 10 | 657.85 | 27 | 640.85 |
| 1GW5 | 666.58 | 668.47 | 40 | 10 | 656.58 | 40 | 626.58 | A | 30 | 636.58 | 18 | 648.58 | NA | NA |
| 1GW6 | 666.83 | 669.77 | 35 | 5 | 661.83 | 35 | 631.83 | B | 24 | 642.83 | 10 | 656.83 | 20.5 | 646.33 |
| 1GW7 | 704.46 | 707.34 | 60 | 27 | 677.46 | 57 | 647.46 | A,B | NA | NA | 44 | 660.46 | 50 | 654.46 |
| 1GW8 | 665.24 | 667.36 | 35 | 20 | 645.24 | 35 | 630.24 | A | NA | NA | 17 | 648.24 | NA | NA |
| 1GW9 | 665.76 | 668.12 | 80 | 65 | 600.76 | 80 | 585.76 | B | 30 | 635.76 | 17.5 | 648.26 | 28 | 637.76 |
| 1GW10 | 664.44 | 667.38 | 82 | 70 | 594.44 | 80 | 584.44 | B | 33 | 631.44 | 12 | 652.44 | 26 | 638.44 |
| 1GW11 | 664.64 | 667.53 | 18 | 11 | 653.64 | 18 | 646.64 | A | NA | NA | NA | NA | NA | NA |
| 1GW12 | 663.68 | 666.76 | 80 | 70 | 593.68 | 80 | 583.68 | B | 32.5 | 631.18 | 10 | 653.68 | 25 | 638.68 |
| 1GW13 | 665.59 | 668.43 | 121 | 111 | 554.59 | 121 | 544.59 | B | 33 | 632.59 | 13 | 652.59 | 26.5 | 639.09 |
| 1GW14 | 665.41 | 668.21 | 80.5 | 70.5 | 594.91 | 80.5 | 584.91 | B | 30 | 635.41 | 13 | 652.41 | 25 | 640.41 |
| 2GW1 | 665.86 | 667.04 | 40 | 10 | 655.86 | 40 | 625.86 | A,B | 24 | 641.86 | 13 | 652.86 | 30 | 635.86 |
| 2GW2 | 664.44 | 667.34 | 29.5 | 13 | 651.44 | 28 | 636.44 | A | NA | NA | 13.5 | 650.94 | NA | NA |

**Table 1
MONITORING WELL CONSTRUCTION DETAILS AND BOREHOLE LITHOLOGIC DATA¹**

Page 2 of 2

| Well | Ground Elevation ² (ft. MSL) | Casing Elevation ² (ft. MSL) | Depth of Boring (ft) | Screen Top | | Screen Bottom | | Screened Unit ³ | Surface Casing | | Top of Clayey Gravel Alluvium | | Top of Bedrock | |
|------|--|--|-------------------------|---------------|------------------------|---------------|------------------------|----------------------------|----------------|------------------------|-------------------------------|------------------------|----------------|------------------------|
| | | | | Depth (ft) | Elevation (ft. MSL) | Depth (ft) | Elevation (ft. MSL) | | Depth (ft) | Elevation (ft. MSL) | Depth (ft) | Elevation (ft. MSL) | Depth (ft) | Elevation (ft. MSL) |
| 2GW3 | 663.86 | 666.62 | 27 | 11 | 652.86 | 26 | 637.86 | A | NA | NA | 19 | 644.86 | 27 | 636.86 |
| 2GW4 | 665.48 | 667.59 | 39 | 24 | 641.48 | 39 | 626.48 | A | NA | NA | 13 | 652.48 | NA | NA |
| 2GW5 | 663.80 | 665.68 | 35 | 20 | 643.8 | 35 | 628.8 | A | NA | NA | 11.5 | 652.30 | NA | NA |
| 2GW6 | 664.08 | 666.11 | 80 | 65 | 599.08 | 80 | 584.08 | B | 49 | 615.08 | 13 | 651.08 | 37 | 627.08 |
| 2GW7 | 665.33 | 668.13 | 81 | 71 | 594.33 | 81 | 584.33 | B | 32 | 633.33 | 14 | 651.33 | 27 | 638.33 |
| 3GW1 | 663.25 | 666.00 | 35 | 5 | 658.25 | 35 | 628.25 | A,B | 24 | 639.25 | 12.5 | 650.75 | 28 | 635.25 |
| 3GW2 | 662.28 | 665.15 | 27 | 10 | 652.28 | 25 | 637.28 | A | NA | NA | 13 | 649.28 | NA | NA |
| 3GW3 | 678.73 | 681.91 | 42.5 | 24 | 654.73 | 39 | 639.73 | A | NA | NA | 25 | 653.73 | 42.5 | 636.23 |
| 3GW4 | 667.12 | 669.47 | 90.5 | 75.5 | 591.62 | 90.5 | 576.62 | B | 47 | 620.12 | 13 | 654.12 | 32 | 635.12 |
| 4GW1 | 664.83 | 667.61 | 28 | 12 | 652.83 | 27 | 637.83 | A | NA | NA | 18.5 | 646.33 | NA | NA |
| 5GW1 | 753.70 | 756.31 | 60 | 20 | 733.70 | 60 | 693.70 | A | 50 | 703.70 | NA | NA | NA | NA |
| 5GW2 | 685.84 | 688.60 | 50 | 20 | 665.84 | 50 | 635.84 | B | 37 | 648.84 | NA | NA | 33 | 652.84 |
| 5GW3 | 686.29 | 689.16 | 50 | 20 | 666.29 | 50 | 636.29 | B | 35 | 651.29 | NA | NA | 34.5 | 651.79 |
| 5GW4 | 685.48 | 688.74 | 83 | 73 | 612.48 | 83 | 602.48 | B | 39.5 | 645.98 | NA | NA | 33 | 652.48 |
| 5GW5 | 685.63 | 688.89 | 76 | 65 | 620.63 | 75 | 610.63 | B | 40 | 645.63 | 28 | 657.63 | 34 | 651.63 |
| 7GW1 | NS | NS | 64 | 10 | NA | 60 | NA | B | NA | NA | NA | NA | 1.5 | NA |
| PWA1 | 669.63 | 671.23 | 78 | 63 | 606.63 | 78 | 591.63 | B | NA | NA | 22 | 647.63 | 47 | 622.63 |
| PWA2 | 669.39 | 671.68 | 35 | 20 | 649.39 | 35 | 634.39 | A | NA | NA | 20 | 649.39 | NA | NA |

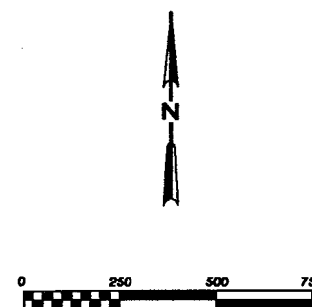
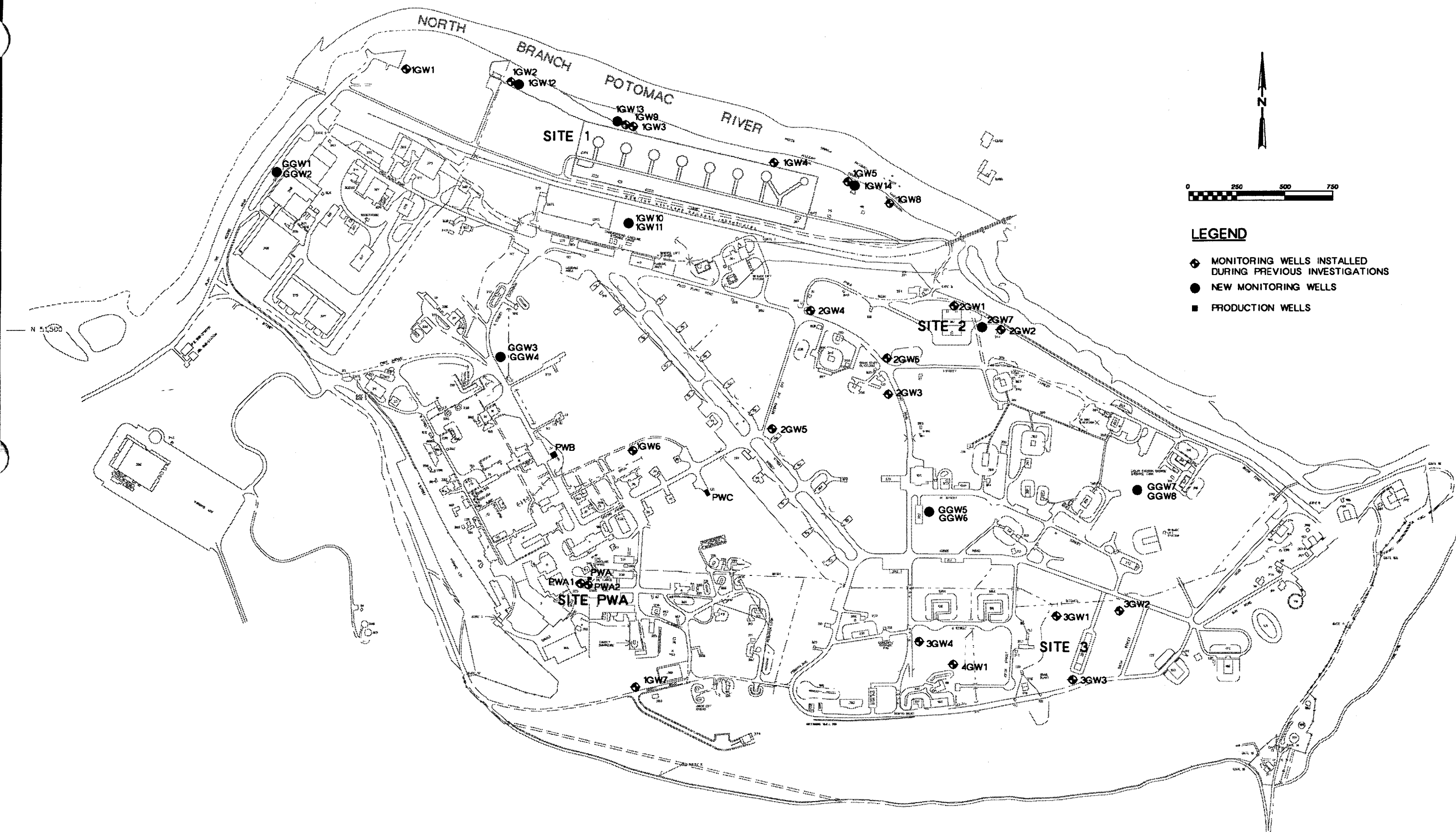
NOTES:

¹All non-survey data for monitoring wells installed during previous investigations were taken from *Draft Interim Remedial Investigation for Allegany Ballistics Laboratory*, Roy F. Weston, Inc. (October 1989).

²Surveyed in August 1992. All elevations are in feet above mean sea level (ft. MSL).

³Screened Unit: A = Alluvium; B = Bedrock; A, B = well screened across the alluvium/bedrock contact.

NA = Not applicable; NS = Not Surveyed



LEGEND

- ◆ MONITORING WELLS INSTALLED DURING PREVIOUS INVESTIGATIONS
- NEW MONITORING WELLS
- PRODUCTION WELLS

Figure 2-5

PLANT 1-MONITORING WELL AND PRODUCTION
WELL LOCATION MAP
ALLEGANY BALLISTICS LABORATORY



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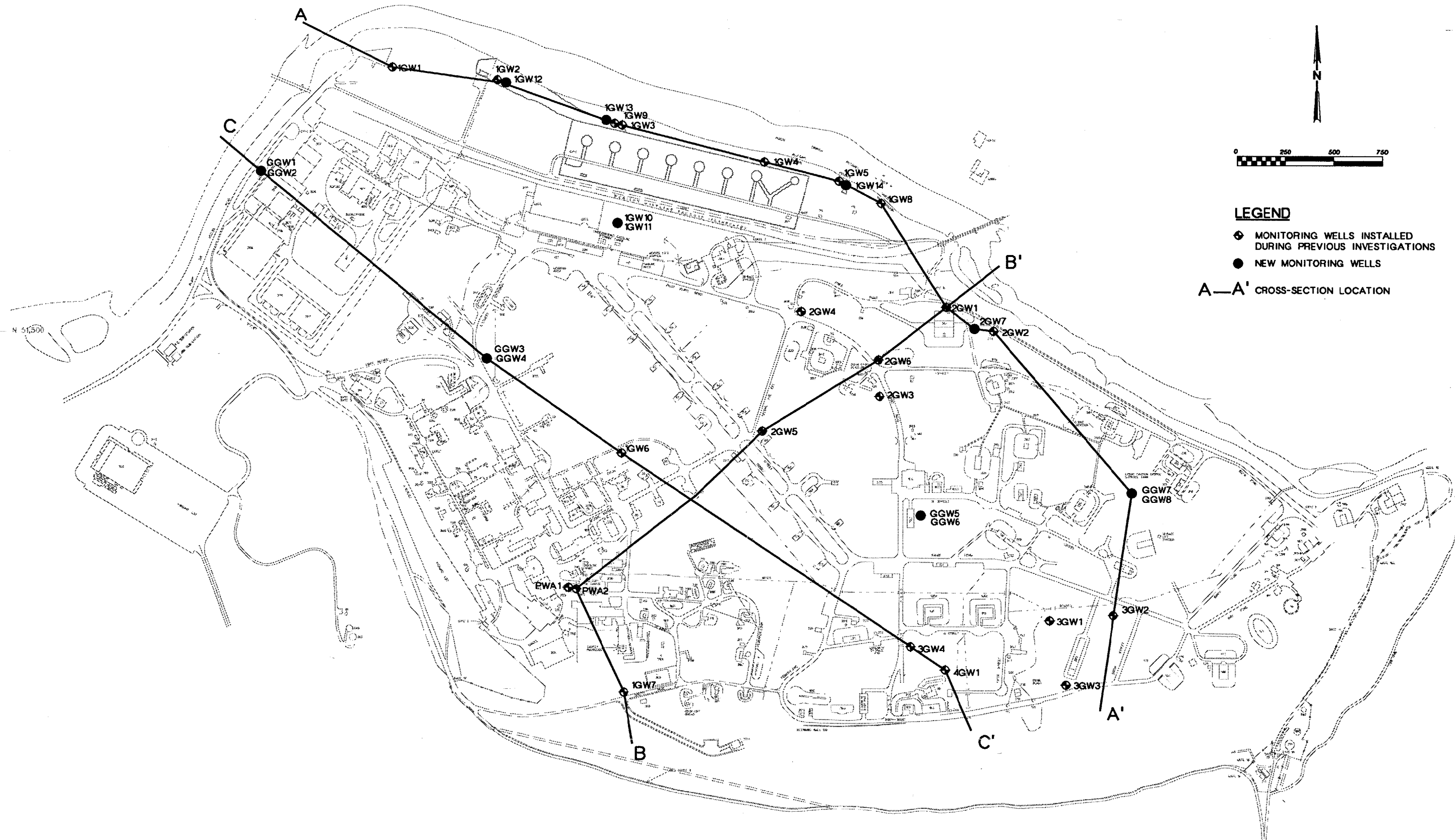
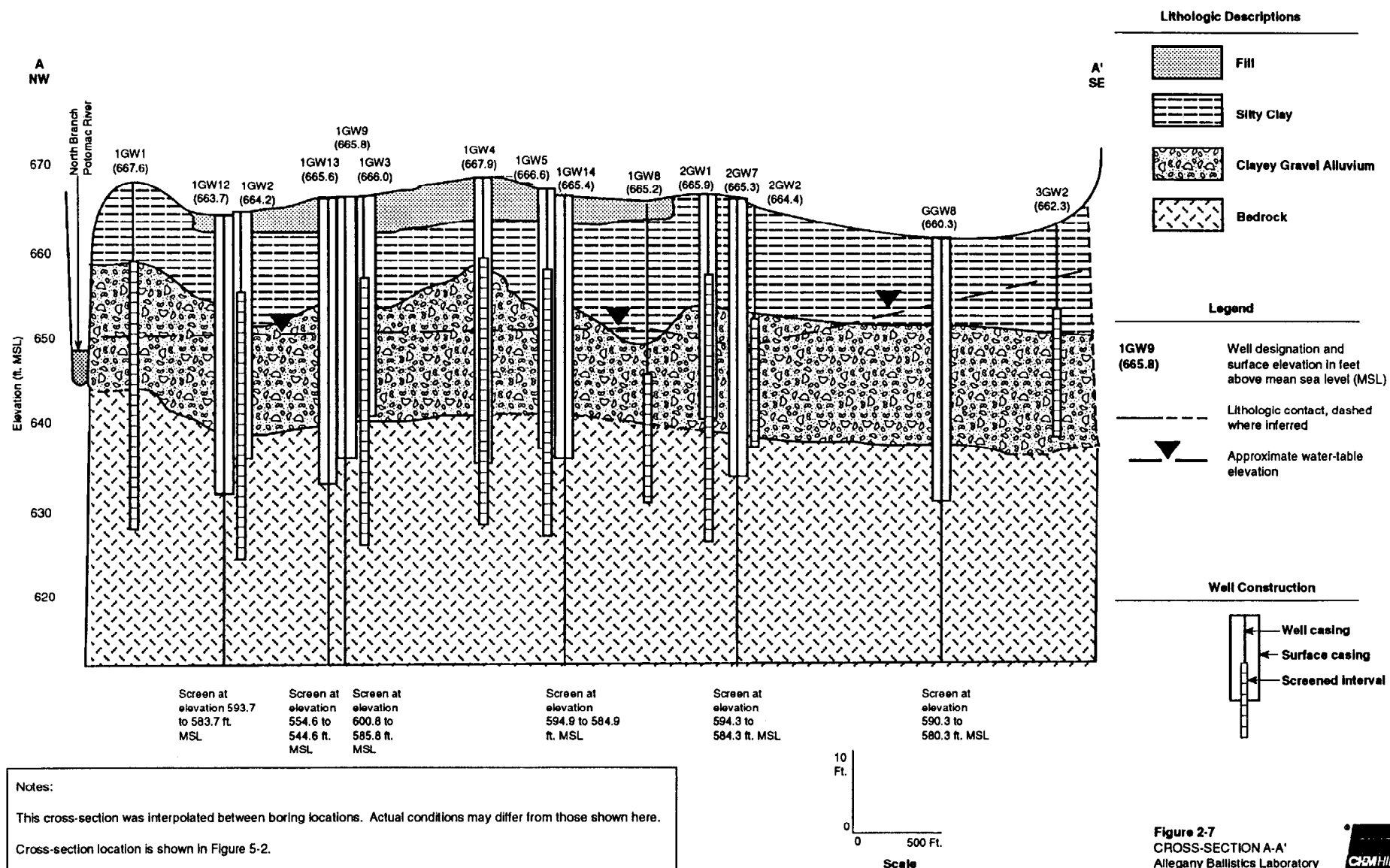
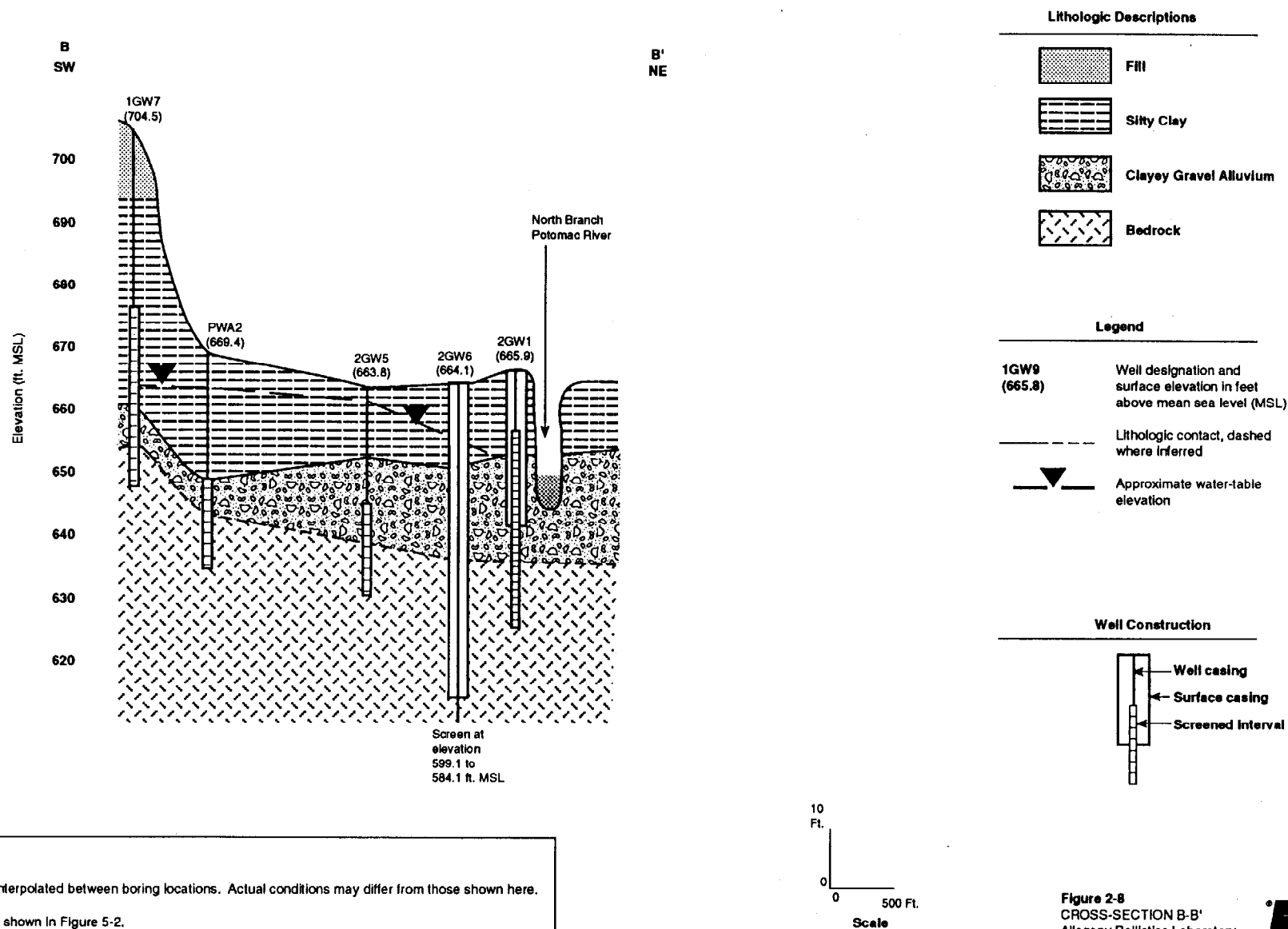
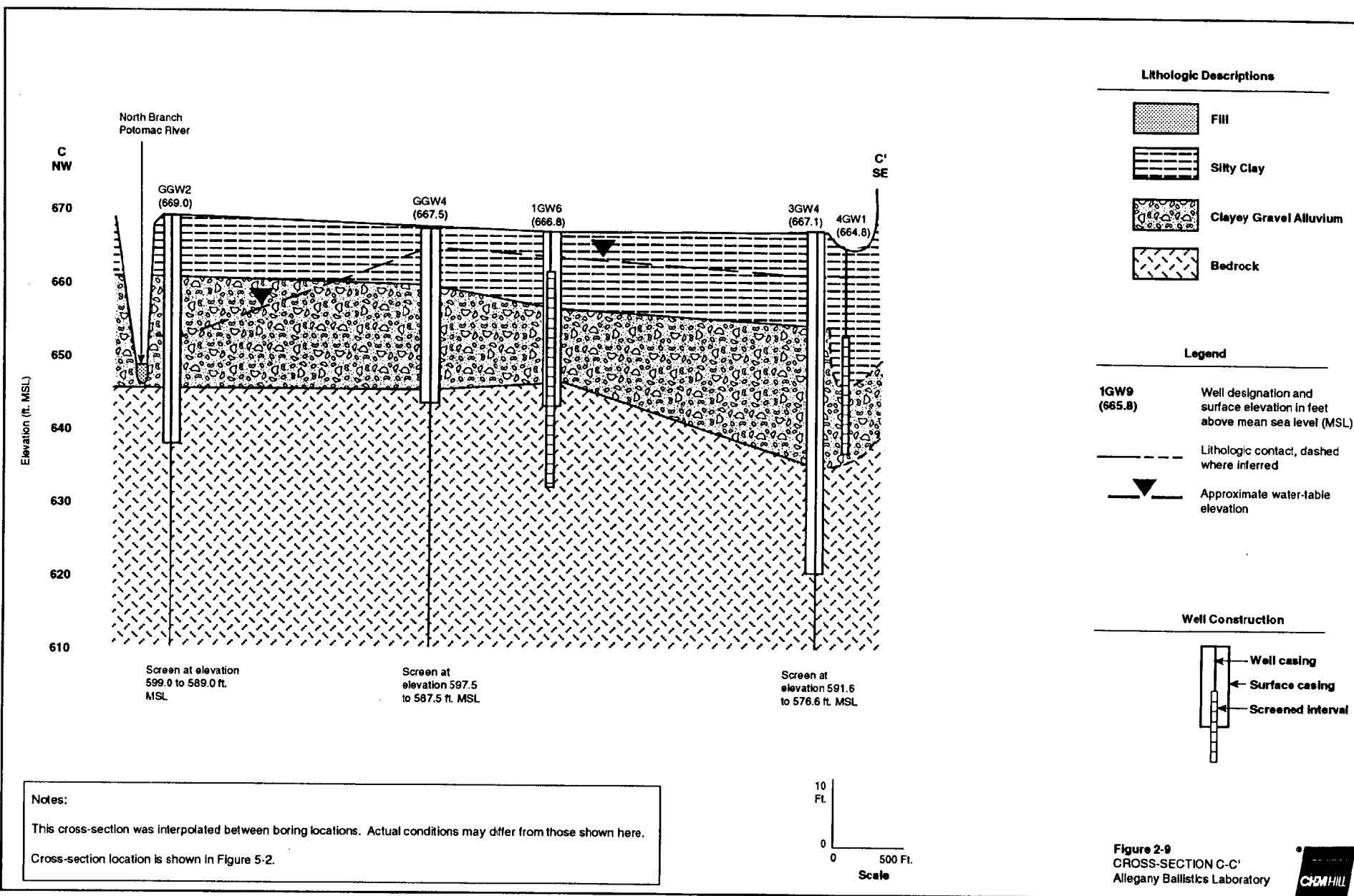


Figure 2-6

PLANT 1 - CROSS-SECTION ALIGNMENTS
ALLEGANY BALLISTICS LABORATORY







The natural surficial material at Plant 1 is a silty clay layer. However, at some locations, particularly along the northern perimeter of Plant 1 adjacent to the river, up to several feet of fill material is located at the surface. The silty clay is typically light to dark brown. Towards the lower portions of the layer it contains traces of fine-grained sand. The thickness of the silty clay layer ranges from about 8 to 25 feet in the majority of Plant 1, averaging approximately 14 feet. The silty clay layer appears to thicken where the surface topography rises toward the base of Knobly Mountain, in the southern portion of Plant 1. This is evidenced by a silty clay layer thickness of 33 feet at Well 1GW7 (Figure 2-8).

Samples from the bottom of the silty clay layer were typically moist to wet. The elevation of the bottom of the silty clay layer ranges from about 645 to 661 feet msl, averaging approximately 652 feet msl. By comparison, the river surface elevation adjacent to Site 1 is estimated on the basis of measurements recorded during the RI, to average 648 feet msl.

An alluvium layer of generally poorly sorted gravel, sand, pebbles, and cobbles with variable, but typically significant amounts of clay and silt underlies the silty clay layer. Pebbles and cobbles generally were well-rounded and composed of sandstone or quartzite, but occasionally were composed of limestone and shale. This layer is greatly heterogeneous. The gravels and pebbles in the alluvium at the locations of monitoring wells GGW1/GGW2, GGW5/GGW6, GGW7/GGW8, 1GW10, and 1GW14, contained significant amounts of clay and silt. At the locations of wells GGW4, 2GW7, and 1GW12, the alluvium contained little or no fines. At Well 1GW13, the alluvium contained interbedded clayey gravels and clean sands.

The alluvium varies in thickness from about 6 to 24 feet at Plant 1. Typical thicknesses are approximately 15 feet. The alluvium generally is saturated through its entire thickness, except near the river. The average elevation of the bottom of the alluvium is about 640 feet msl.

Bedrock

Bedrock consisting of shale and limestone underlies the alluvium at Plant 1. Bedrock drilling during the RI at nine locations at Plant 1 revealed that shale is the most prevalent bedrock type beneath the site, particularly beneath the eastern half of Plant 1. The shale, however, is slightly calcareous² at most locations, and contains visible calcite veins in a few places. No sandstone was encountered at ABL. However, the shale was noticeably siliceous in some beds. Limestone was not encountered east of Well 1GW10, except for some traces of argillaceous³ limestone seen at Well 1GW14. The bedrock at wells 1GW10, 1GW12, and GGW4 consists of calcareous shale and argillaceous limestone; the limestone and shale are interbedded at wells GGW4 and 1GW10. At the location of the westernmost bedrock well, Well GGW2, bedrock consists of a calcite-veined limestone

²Contains calcite as a noteworthy minor constituent.

³Clayey.

interbedded with a highly weathered shale. Drilling the borehole for Well GGW2 revealed a large void extending from approximately 80 to 82.5 feet below the ground surface. No other noticeable voids were encountered during bedrock drilling at ABL.

The bedrock characterization performed during the RI was based strictly on the examination of air-rotary drill cuttings; no rock-core samples were obtained. Drill cuttings do not preserve bedding relationships and structural features. Consequently, no attempt has been made to categorize the bedrock encountered at a particular well location according to the stratigraphic units defined in Table 2-1 for the regional geology. However, some general statements can be made.

The bedrock encountered at the westernmost monitoring well at Plant 1, Well GGW2, is most likely the limestone and shale of the Tonoloway Formation of Upper Silurian age (see Table 2-1). This is evinced by the composition of the rock; the location of the well in relation to regional geologic reports, which include mapped outcroppings north of Plant 1 at Pinto, Maryland; and the presence of voids in the limestone; geological literature documents the presence of solution channels and the development of karst topography above the Tonoloway Formation (Dyott, 1956; Clark, 1976).

The shales and occasional limestones of the Wills Creek, Mifflintown, and Rose Hill Formations probably constitute the bedrock beneath the remaining majority of Plant 1. No attempt was made to categorize the wells according to specific formation. However, the boreholes for monitoring wells GGW6 and 2GW7 definitely intersect the top of the Keefer Member of the Mifflintown Formation, as evinced by distinctive red-colored oolitic hematite encountered during drilling.

The elevation of the top of the bedrock surface at Plant 1 generally ranges from about 654 feet msl to a low of about 635 feet msl, averaging about 640 feet msl. Figure 2-10 presents a map of bedrock surface elevations across Plant 1, and provides interpretive contours at 5-foot intervals.

Both the bedrock surface contour map in Figure 2-10, and cross section in Figure 2-8, are based on questionable data from previous investigations. The reported depths to bedrock for wells PWA2, 2GW5, and 2GW6 may be invalid. Previous investigations relied exclusively on the interpretation of air-rotary drill cuttings to determine lithologic contacts, a method that can be very unreliable. The boring logs for wells PWA2 and 2GW5, indicate that the wells were drilled to elevations of approximately 634 and 629 feet msl, respectively, without encountering bedrock. This suggests the presence of a bedrock valley or depression. However, at production Well PWA, approximately 30 feet away from Well PWA2, a downhole television survey made during the RI indicated that in the vicinity of Well PWA bedrock occurs at an elevation of approximately 645 feet msl. In addition, the borehole log for Well 2GW5 indicates the presence of "rock fragments" in cuttings from near the bottom of the hole. These rock fragments might indicate that the borehole had entered bedrock after all, and at an elevation consistent with data collected during the recent RI. The recent data offers no evidence of a bedrock valley or depression beneath

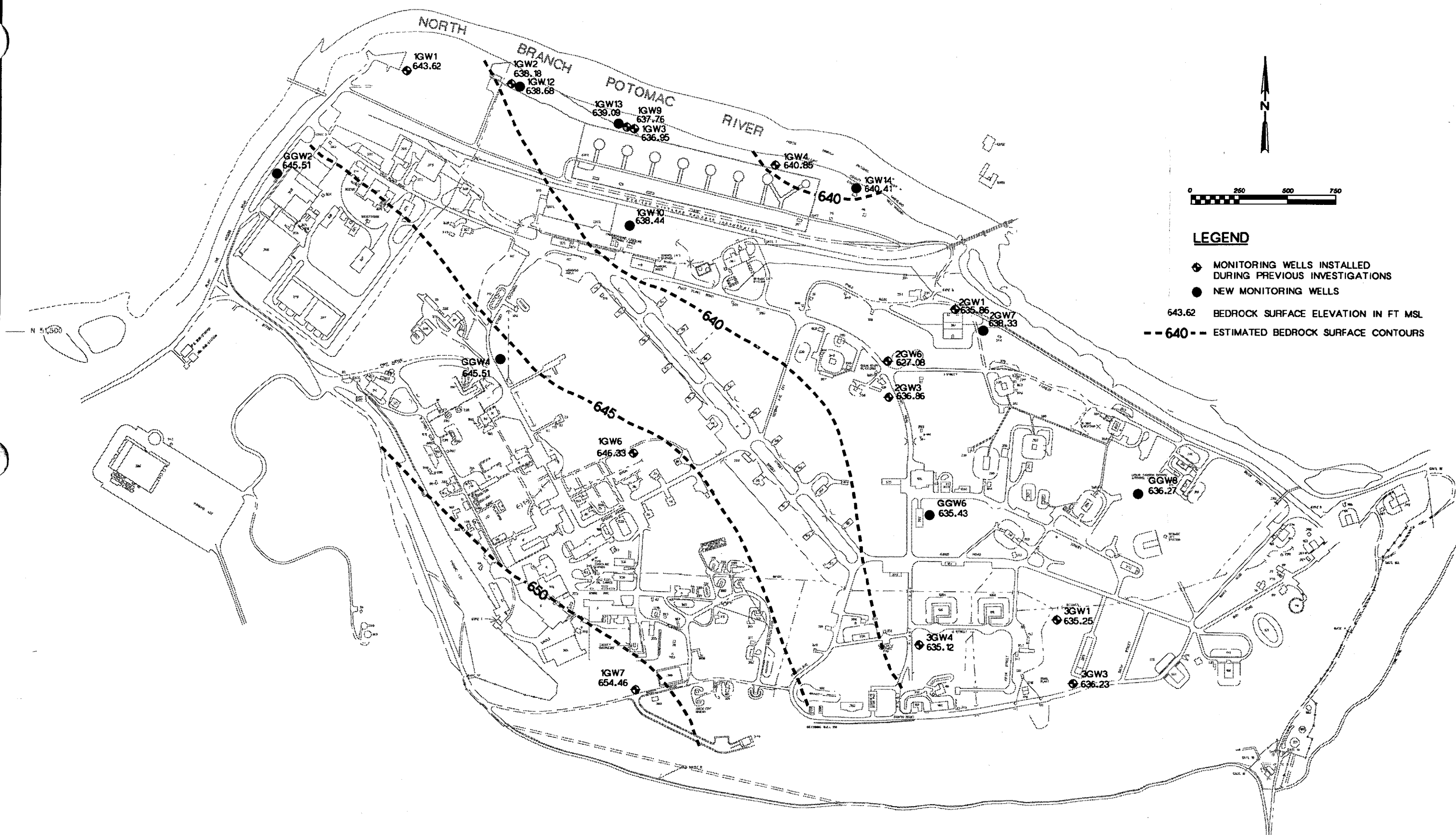


Figure 2-10

PLANT 1 - BEDROCK SURFACE ELEVATIONS
ALLEGANY BALLISTICS LABORATORY



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Plant 1. Additional data could establish the presence of such significant features. Consequently, in Figure 2-8, the top of bedrock has been indicated with a dashed line at elevations higher than reported in previous investigations. In addition, the reported depth to bedrock at Well 2GW6, which would indicate a bedrock surface at about 627 feet msl, was not used for purposes of contouring the bedrock surface in Figure 2-10.

Hydrogeology

In order to develop a conceptual hydrogeologic model of ABL, data and information were reviewed and interpreted. Boring logs and well completion diagrams of monitoring wells installed during the RI and Interim RI were interpreted. Also interpreted were the slug tests conducted during the RI to assess the hydraulic properties of the alluvial aquifer underlying Plant 1 and the straddle-packer tests conducted at production well PWA to evaluate the yields of isolated fracture intervals within the borehole, and to assess the degree of vertical interconnection between these intervals. The water-level measurements recorded at all monitoring wells on Plant 1 to evaluate the directions and rates of flow in the alluvial and bedrock aquifers beneath Plant 1 and the long-term water-level monitoring of the North Branch Potomac River and adjacent alluvial and bedrock wells at Site 1 to assess the degree of hydraulic interconnection between the aquifers and the river were interpreted. Hydrogeologic information contained in the reports from previous investigations was reviewed and interpreted.

During the RI, some apparent errors were discovered in the data presented in the Interim RI concerning the screened units of monitoring wells. The errors that affect the development of a conceptual hydrogeologic model of the site are discussed briefly below.

Table 2-2 includes construction specifications for monitoring wells installed during the RI and previous investigations. On the basis of a review of the information from the Interim RI Report, monitoring wells 1GW2, 1GW4, 1GW6, 2GW1, and 3GW1 were determined to have been assigned to the wrong hydrogeological units. Wells that reportedly were screened across the alluvium/bedrock contact because of very long screen zones (wells 1GW2, 1GW4, and 1GW6), have been reinterpreted as being screened only in bedrock because their steel casings are reported to extend from the surface into the bedrock, presumably eliminating contact of the screens with the alluvium. Also, wells 2GW1 and 3GW1, which were reported in the Interim RI as being screened only in the bedrock, have been reinterpreted as being screened across the alluvium/bedrock contact because the reported depths of the steel surface casings do not reach the reported depths of the bedrock surface. The designations of the screened units for these wells have been revised in Table 2-2 to reflect the reinterpretations.

The geological information obtained during the RI indicates that the alluvium, which generally consists of clayey gravel, pebbles, and sand, constitutes the shallow aquifer beneath Plant 1. The alluvium is saturated throughout most of Plant 1, except close to the river at Site 1. The fractured bedrock underlying the alluvium constitutes a second, deeper

aquifer that is to some degree hydraulically connected with the alluvium. Because of the lithologic differences between the alluvium and bedrock, the two units will be considered for discussion purposes as separate aquifers with some hydraulic interconnection.

Alluvial Aquifer

Slug tests were conducted at eight monitoring wells during the RI to provide estimates of the hydraulic conductivity of the alluvial aquifer. The test results are presented in Table 2-3. The observed hydraulic conductivities range from 1×10^{-5} centimeters per second (cm/sec), to 5×10^{-3} cm/sec with a median of approximately 6×10^{-4} cm/sec. The large range in hydraulic conductivities reflects the heterogeneity of the alluvium. At locations where the alluvium had a high clay content (wells GGW5, GGW7, 1GW11, and 3GW3), hydraulic conductivities were in the range of 10^{-5} to 10^{-4} cm/sec. Where the alluvium was relatively free of clay (wells GGW3, 1GW8, and PWA2), hydraulic conductivities were on the order of 10^{-3} cm/sec.

Water-level measurements recorded from all monitoring wells at ABL within a 4.5-hour period during the RI are presented in Table 2-4. The measurements from wells screened in the alluvial aquifer⁴ were used to produce an interpretive contour map of the water levels (piezometric surface) in the alluvial aquifer (see Figure 2-11). The piezometric-surface contour map indicates that, on the scale of Plant 1 as a whole, the alluvial aquifer flow is generally toward the river. Beneath the eastern two-thirds (including Site 1) of Plant 1, groundwater flows predominantly toward the river in a northeasterly direction. Beneath the western one-third of the plant, groundwater flows generally toward the river in a northerly or northwesterly direction. The piezometric surface appears to slope relatively uniformly toward the river along the northern Plant 1 perimeter, but is noticeably flat in the south-central portion of Plant 1.

The top and bottom elevations of the alluvium are approximately 652 and 640 feet msl, respectively. During average flow conditions along Site 1 in the vicinity of Well 1GW13, the river level was twice measured at approximately 648 feet msl. The river level is therefore located within the elevation range of the alluvial aquifer across Plant 1. The elevation of the river and nearby shallow aquifer suggest that the river is the ultimate discharge zone for groundwater flowing laterally through the alluvium.

The term hydraulic gradient is defined as the change in hydraulic head between two measuring points. The horizontal hydraulic gradients at Plant 1 within the alluvial aquifer range from a low of approximately 0.002 feet per horizontal foot between the 662 feet msl

⁴Water-level measurements from five wells screened across the alluvium/ bedrock contact also were used. Although the majority of the screened zone in these wells is in the alluvium, the water-level measurements from these wells are questionable because of compositing.

| <p align="center">Table 2-3 SUMMARY OF SLUG TEST RESULTS AT WELLS SCREENED IN THE ALLUVIUM</p> | | | | | |
|---|---------------------|--|--------------------|--|-----------------|
| Well | Date of Test | Nature of Alluvium in the Screened Zone | Test Number | Computed Hydraulic Conductivity | |
| | | | | (cm/s) | (ft/day) |
| GGW3 | 7-30-92 | Sand and gravel | 1 | 4×10^{-3} | 12 |
| | | | 2 | 4×10^{-3} | 12 |
| GGW5 | 7-29-92 | Clayey gravel | 1 | 7×10^{-5} | 0.2 |
| | | | 2 | 9×10^{-5} | 0.3 |
| GGW7 | 7-30-92 | Clayey gravel | 1 | 1×10^{-4} | 0.3 |
| | | | 2 | 1×10^{-5} | 0.04 |
| 1GW8 | 8-12-92 | Sand and gravel | 1 | 2×10^{-3} | 5 |
| | | | 2 | 2×10^{-3} | 5 |
| 1GW11 | 8-13-92 | Clayey sand and gravel | 1 | 2×10^{-4} | 0.7 |
| | | | 2 | 3×10^{-4} | 0.7 |
| 2GW4 | 7-30-92 | Sand and gravel, trace clay | 1 | 9×10^{-4} | 2 |
| | | | 2 | 1×10^{-3} | 3 |
| 3GW3 | 8-12-92 | Clayey gravel | 1 | 2×10^{-5} | 0.05 |
| | | | 2 | 2×10^{-5} | 0.05 |
| PWA2 | 7-28-92 | Sand and gravel | 1 | 5×10^{-3} | 15 |
| | | | 2 | 5×10^{-3} | 13 |

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Table 2-4
SUMMARY OF WATER LEVEL MEASUREMENTS¹

Page 1 of 3

| Well | Ground Elevation ² (ft. MSL) | Casing Elevation ² (ft. MSL) | Screen Depth Interval (ft) | Screened Unit ³ | Casing to Water Level (ft) | Water Level Elevation ² (ft. MSL) |
|-------|---|---|-------------------------------|----------------------------|-------------------------------|--|
| GGW1 | 668.79 | 671.65 | 18-23 | A | 19.06 | 652.59 |
| GGW2 | 669.01 | 672.07 | 70-80 | B | 19.60 | 652.47 |
| GGW3 | 667.53 | 670.57 | 12-22 | A | 5.92 | 664.65 |
| GGW4 | 667.51 | 670.66 | 70-80 | B | 7.08 | 663.58 |
| GGW5 | 663.92 | 666.59 | 15.5-25.5 | A | 6.38 | 660.21 |
| GGW6 | 663.93 | 666.75 | 70-80 | B | 6.96 | 659.79 |
| GGW7 | 660.36 | 663.21 | 13-23 | A | 8.74 | 654.47 |
| GGW8 | 660.27 | 663.21 | 70-80 | B | 10.96 | 652.25 |
| 1GW1 | 667.62 | 670.09 | 10-40 | A,B | 19.74 | 650.35 |
| 1GW2 | 664.18 | 666.79 | 10-40 | B | 18.14 | 648.65 |
| 1GW3 | 665.95 | 668.25 | 10-40 | A,B | 18.55 | 649.70 |
| 1GW4 | 667.85 | 670.51 | 10-40 | B | 20.33 | 650.18 |
| 1GW5 | 666.58 | 668.47 | 10-40 | A | 17.70 | 650.77 |
| 1GW6 | 666.83 | 669.77 | 5-35 | B | 5.96 | 663.81 |
| 1GW7 | 704.46 | 707.34 | 27-57 | A,B | 43.09 | 664.25 |
| 1GW8 | 665.24 | 667.36 | 20-35 | A | 16.57 | 650.79 |
| 1GW9 | 665.76 | 668.12 | 65-80 | B | 19.73 | 648.39 |
| 1GW10 | 664.44 | 667.38 | 70-80 | B | 11.00 | 656.38 |

Table 2-4
SUMMARY OF WATER LEVEL MEASUREMENTS¹

Page 2 of 3

| Well | Ground Elevation ² (ft. MSL) | Casing Elevation ² (ft. MSL) | Screen Depth Interval (ft) | Screened Unit ³ | Casing to Water Level (ft) | Water Level Elevation ² (ft. MSL) |
|-------|---|---|-------------------------------|----------------------------|-------------------------------|--|
| 1GW11 | 664.64 | 667.53 | 11-18 | A | 10.44 | 657.09 |
| 1GW12 | 663.68 | 666.76 | 70-80 | B | 17.83 | 648.93 |
| 1GW13 | 665.59 | 668.43 | 111-121 | B | 17.98 | 650.45 |
| 1GW14 | 665.41 | 668.21 | 70.5-80.5 | B | 17.96 | 650.25 |
| 2GW1 | 665.86 | 667.04 | 10-40 | A,B | 15.50 | 651.54 |
| 2GW2 | 664.44 | 667.34 | 13-28 | A | 18.68 | 648.66 |
| 2GW3 | 663.86 | 666.62 | 11-26 | A | 9.03 | 657.59 |
| 2GW4 | 665.48 | 667.59 | 24-39 | A | 12.52 | 655.07 |
| 2GW5 | 663.80 | 665.68 | 20-35 | A | 4.32 | 661.36 |
| 2GW6 | 664.08 | 666.11 | 65-80 | B | 10.96 | 655.15 |
| 2GW7 | 665.33 | 668.13 | 71-81 | B | 14.46 | 653.67 |
| 3GW1 | 663.25 | 666.00 | 5-35 | A,B | 7.24 | 658.76 |
| 3GW2 | 662.28 | 665.15 | 10-25 | A | 9.24 | 655.91 |
| 3GW3 | 678.73 | 681.91 | 24-39 | A | 21.64 | 660.27 |
| 3GW4 | 667.12 | 669.47 | 75.5-90.5 | B | 8.44 | 661.03 |
| 4GW1 | 664.83 | 667.61 | 12-27 | A | 6.74 | 660.87 |
| 5GW1 | 753.70 | 756.31 | 20-60 | A | 29.68 | 726.63 |
| 5GW2 | 685.84 | 688.60 | 20-50 | B | 22.62 | 665.98 |

Table 2-4
SUMMARY OF WATER LEVEL MEASUREMENTS¹

Page 3 of 3

| Well | Ground Elevation ² (ft. MSL) | Casing Elevation ² (ft. MSL) | Screen Depth Interval (ft) | Screened Unit ³ | Casing to Water Level (ft) | Water Level Elevation ² (ft. MSL) |
|------|---|---|-------------------------------|----------------------------|-------------------------------|--|
| 5GW3 | 686.29 | 689.16 | 20-50 | B | 22.72 | 666.44 |
| 5GW4 | 685.48 | 688.74 | 73-83 | B | 27.92 | 660.82 |
| 5GW5 | 685.63 | 688.89 | 65-75 | B | 22.46 | 666.43 |
| PWA1 | 669.63 | 671.23 | 63-78 | B | 7.40 | 663.83 |
| PWA2 | 669.39 | 671.68 | 20-35 | A | 7.80 | 663.88 |

NOTES:

¹Water level measurements taken during 4.5-hour period on 8-12-92.

²All elevations are in feet above mean sea level (ft. MSL).

³Screened Unit: A = Alluvium; B = Bedrock; A,B = Well screened across the alluvium/bedrock contact.

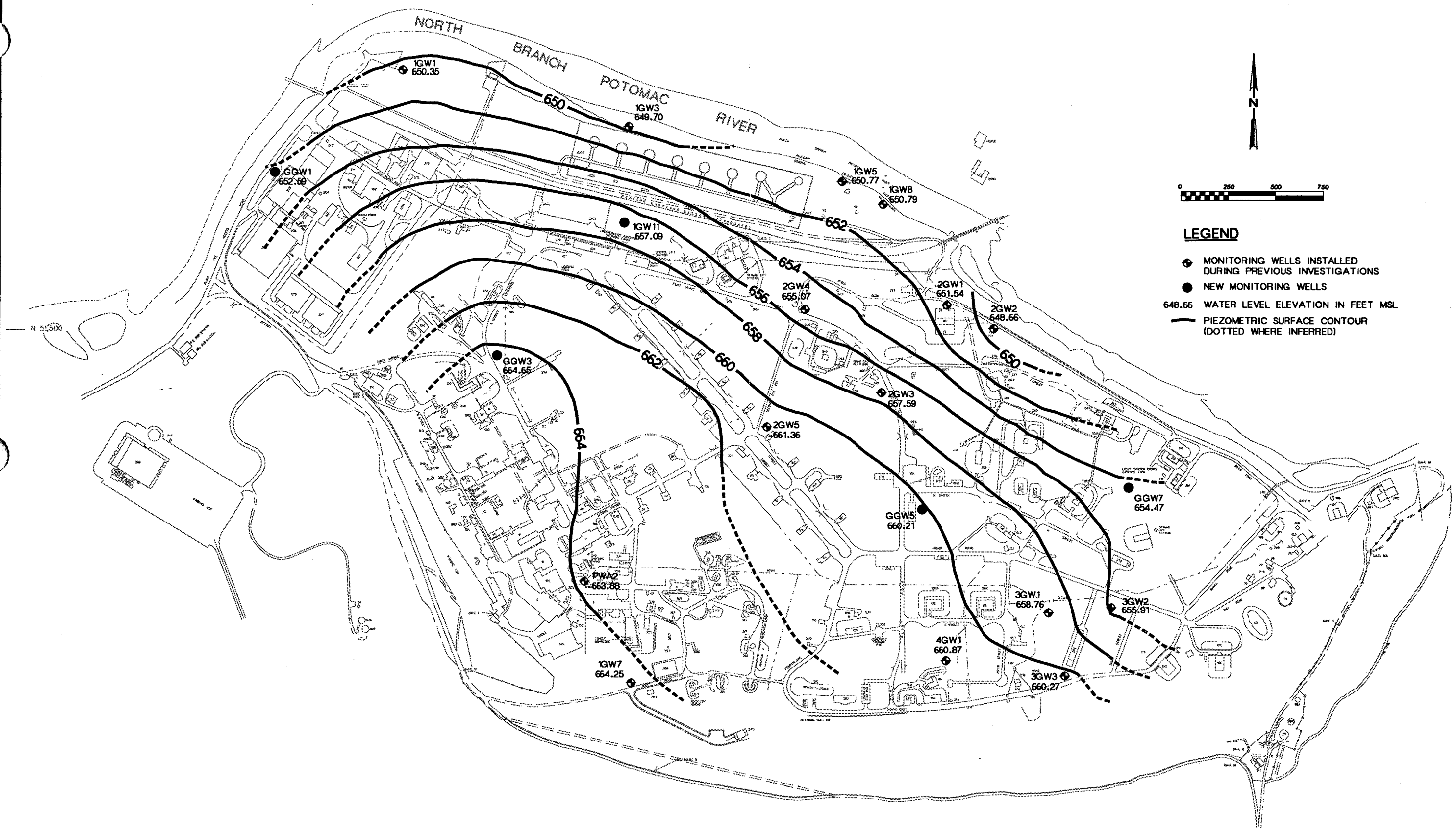


Figure 2-11

PLANT 1 - PIEZOMETRIC SURFACE OF THE
ALLUVIAL AQUIFER
ALLEGANY BALLISTICS LABORATORY



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contour and Well GGW5 in the south central portion of Plant 1, to a high of approximately 0.015 between wells 1GW11 and 1GW3 near the northern perimeter of the facility across Site 1.

Using estimates of hydraulic conductivity and horizontal hydraulic gradient, the average linear velocity of horizontal groundwater flow can be calculated. The average linear velocity of horizontal groundwater flow is equal to the product of the hydraulic gradient and the hydraulic conductivity, divided by the effective porosity of the aquifer material. Adjacent to the river at Site 1, where the steepest hydraulic gradients at Plant 1 are located, the estimated average linear velocity ranges from approximately 1 to 400 feet per year (ft/yr), with a median linear velocity of approximately 47 ft/yr. In the south-central portion of Plant 1 where the hydraulic gradients are flattest, the estimated average linear velocity ranges from 0.1 to 52 ft/yr, with a median linear velocity of approximately 6 ft/yr. These calculations assume an effective alluvium porosity of 20 percent. The large range of average linear velocities reflects the wide range of alluvial hydraulic conductivities.

Bedrock Aquifer

Unlike the alluvial aquifer, lateral groundwater flow in the bedrock aquifer is confined to fractures and solution channels. The directions and rates of groundwater movement in fractured bedrock are controlled by the size, frequency, and orientation of fractures and by the hydraulic gradient. Because of the significant number of compositionally and structurally varied bedrock stratigraphic units underlying ABL, the hydraulic characteristics of the bedrock aquifer are likely to vary greatly across the site.

One estimate of the hydraulic properties of a portion of the bedrock aquifer was calculated during a previous investigation. An 8-hour pumping test conducted in production well PWA produced an estimate of the transmissivity of the bedrock on the order of 2,000 to 6,300 gallons per day per foot in the vicinity of the well. The results of the pumping test also indicated a hydraulic connection between the alluvial and bedrock aquifers.

At eight locations on Plant 1, a monitoring well screened in the alluvium is located within about 20 feet of a well screened in bedrock. Water-level measurements from these paired wells were compared in order to determine the direction and magnitude of the vertical component of the hydraulic gradient between the alluvial and bedrock aquifers. The results, presented in Table 2-5, indicate that the calculated vertical components of flow between the alluvium and bedrock were downward at all locations, with gradients of varied magnitude. The alluvial and bedrock aquifers are most likely well connected at locations where the vertical hydraulic gradient is small.

Figure 2-12 presents an interpretive contour map of the piezometric surface in the bedrock aquifer, derived from the water-level elevations in monitoring wells screened entirely in bedrock. The contour map indicates that the horizontal flow patterns in the bedrock are similar to those in the overlying alluvium. The horizontal hydraulic gradients are similar

Table 2-5
CALCULATED VERTICAL COMPONENT OF THE HYDRAULIC GRADIENT
AT PAIRED WELLS IN THE ALLUVIUM AND BEDROCK

| Well Pair ^a | Measured Difference in Water Level Elevations (ft) | Distance Between Well Screens ^b (ft—max/min) | Vertical Component of Hydraulic Gradient (max/min) | Direction of Vertical Component of Flow |
|------------------------|---|---|--|--|
| GGW1/GGW2 | -0.12 | 62/47 | 0.0026/0.0019 | Down |
| GGW3/GGW4 | -1.07 | 68/48 | 0.022/0.016 | Down |
| GGW5/GGW6 | -0.42 | 64/44 | 0.0095/0.0066 | Down |
| GGW7/GGW8 | -2.22 | 67/47 | 0.047/0.033 | Down |
| 1GW11/1GW10 | -0.71 | 69/52 | 0.014/0.010 | Down |
| 1GW3/1GW9 ¹ | -1.31 | 70/25 | 0.052/0.019 | Down |
| 1GW5/1GW14 | -0.52 | 72/32 | 0.016/0.0072 | Down |
| PWA2/PWA1 | -0.05 | 58/28 | 0.0018/0.00086 | Down |

NOTES:

^aAlluvial well/bedrock well.

^bMax = Top of screen for alluvial well minus bottom of screen for bedrock well.

Min = Bottom of Screen for alluvial well minus top of screen for bedrock well.

¹1GW3 is screened across the alluvium/bedrock contact, while 1GW9 is screened entirely in bedrock.

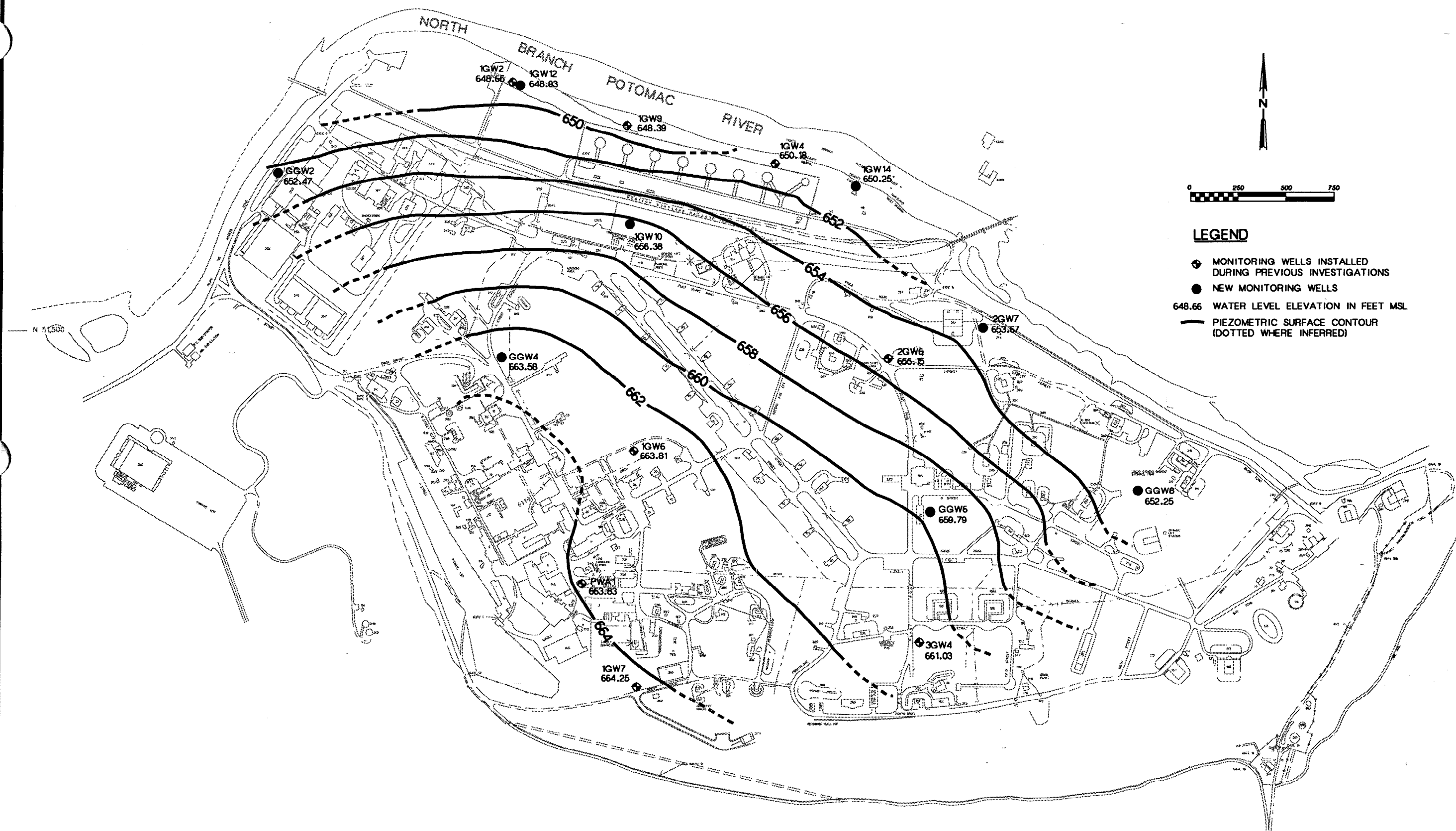


Figure 2-12

PLANT 1 - PIEZOMETRIC SURFACE OF
BEDROCK AQUIFER
ALLEGANY BALLISTICS LABORATORY



00396604Z

also, ranging from approximately 0.003 in the south-central portion of the site between the 662 feet msl contour and Well GGW6, to 0.016 between wells 1GW11 and 1GW3 near the northern perimeter of the facility at Site 1.

As discussed with the Site Geology, the two principal fracture orientations measured near ABL had average strikes of N26°E and N39°W; Fracture Set 1 is roughly parallel to the strike of bedding planes in the Wills Mountain anticlinorium and Fracture Set 2 is oblique to the general structural trend. Fracture orientations similar to either of these sets in the bedrock beneath Plant 1 would facilitate the movement of groundwater toward the North Branch Potomac River. The water-level contour map of bedrock indicates that the general direction of the groundwater flow beneath the eastern two-thirds of Plant 1 is roughly parallel to the strike of Fracture Set 1. The general direction of groundwater flow beneath the western one-third of Plant 1 is roughly parallel to the strike of Fracture Set 2.

Solution-widened fractures in limestone and dolomite bedrock can facilitate rapid migration of groundwater. RI drilling did not reveal large solution channels except at Well GGW2, the westernmost bedrock well at Plant 1. As stated in Section 5, this well is thought to be screened in limestone and shale of the Tonoloway Formation, with characteristic solution cavities and karst topography. Bedrock drilling east of Well GGW2 during the RI revealed predominantly shale bedrock without voids or large solution cavities. However, because of the relatively few bedrock drilling locations at Plant 1, solution channels could have developed at other locations and not been discovered.

Water-level measurements were recorded on two occasions in a well cluster at Site 1 adjacent to the North Branch Potomac River; measurements of the water level in the river adjacent to the wells were recorded simultaneously. The measured wells included Well 1GW3 (screened across the alluvium/bedrock contact, from 24 to 40 feet below ground), Well 1GW9 (screened in moderately deep bedrock from 65 to 80 feet below ground), and Well 1GW13 (screened in deeper bedrock from 111 to 121 feet below ground). These measurements permit a comparison of well water level with river water level. They also permit evaluation of the vertical component of the hydraulic gradient between the alluvium and shallow bedrock, and between the shallow and deep bedrock. The water-level measurements are reported in Table 2-6. The results of the comparisons indicate a downward vertical component of groundwater flow at this location between the alluvium/shallow bedrock and moderately deep bedrock. However, vertical groundwater flow between moderately deep bedrock and deeper bedrock was upward. The magnitude and direction of the gradients were consistent between measurement periods. Moreover, the water level in the moderately deep bedrock well (Well 1GW9) was slightly higher than the river level. Relative to the other wells, Well 1GW9 was closest to the river level. On the basis of these results, the bedrock aquifer appears to be hydraulically connected to the river at this location. Because the top-of-bedrock surface adjacent to the river at this location was measured at approximately 640 feet msl, compared to the river level at about 648 feet msl, the hydraulic connection is probably transmitted through some thickness of alluvial sediments beneath the river channel. A hydraulic connection between the bedrock

Table 2-6
WATER LEVELS AT SELECTED ALLUVIUM AND BEDROCK
MONITORING WELLS ADJACENT TO THE NORTH BRANCH POTOMAC
RIVER

| Location | Screened Unit¹ | Screen Depth Interval (ft) | Water Level (ft. MSL) 8-31-92 | Water Level (ft. MSL) 9-16-92 |
|-----------------|----------------------------------|-----------------------------------|--------------------------------------|--------------------------------------|
| 1GW3 | A,B | 24-40 ² | 649.20 | 648.75 |
| 1GW9 | B | 65-80 | 648.30 | 648.06 |
| 1GW13 | B | 111-121 | 650.35 | 650.17 |
| River | | | 648.07 | 647.98 |

NOTES:

¹Screened Unit: A = Alluvium; B = Bedrock; A,B = Well screened across the alluvium/bedrock contact.

²Effective screen zone. Although the well screen extends from 10-40 ft., a steel surface casing extends from the surface to a depth of 24 ft.

WDCR805/010.WP5/2

and the river does not eliminate the possibility that some portion of horizontal groundwater flow crosses beneath the river. Without measurements of groundwater levels north of the river, the potential for this flow cannot be evaluated.

Simultaneous water-level measurements also were recorded continuously (i.e., at 15-minute intervals using pressure transducers and a datalogger) at wells 1GW3 and 1GW9 and the river for a period of approximately 5 weeks. Long-term water-level monitoring helped to determine the degree of hydraulic interconnection between the river and the alluvial and bedrock aquifers. The water-level changes in the bedrock well (Well 1GW9) correspond very closely in time and magnitude to changes in river level. This indicates a strong hydraulic connection between the bedrock aquifer and the river. However, the water-level changes in the well screened across the alluvium/bedrock contact (Well 1GW3) show only occasional very subdued responses to river-level changes, which would indicate an unexpectedly poor hydraulic connection with the river.

Well construction may explain the poor response of Well 1GW3 to the changes in the river level. Installed during the Interim RI, this well has a screen zone extending from 10 to 40 feet below ground. However, a steel surface casing extends from the ground surface to 24 feet below ground, reducing the effective screen zone to the interval from 24 to 40 feet below ground. During the installation of Well 1GW13, adjacent to Well 1GW3, bedrock was encountered at 26.5 feet below ground surface, and water-bearing fractures in bedrock were not encountered until a depth of approximately 62 feet. This means that Well 1GW3 is screened approximately 2.5 feet in alluvium and 13.5 feet in bedrock that is potentially devoid of fractures. Moreover, the alluvium at the 24 to 26.5 foot depth at this location was characterized during the RI as a clayey gravel, which generally has relatively low permeabilities. The limited exposure of Well 1GW3 to the alluvium, combined with the relatively low permeability of the alluvium at the location, may explain the poor response of Well 1GW3 to the changes in river level. These results likely are not indicative of the general degree of hydraulic connection between the alluvium and the river. Therefore, it is still conceivable that a hydraulic connection exists.

WDCR811/008.WP5

Section 3

Initial Evaluation

This section discusses the contamination detected for each medium sampled at Site 1. These include, soil, groundwater, surface water, and sediment.

Soil Contamination

Except for a few soil samples collected about the drum storage pad during the IAS, the RI was the only previous investigation that involved the collection and analysis of soil samples at Site 1. However, a soil gas survey was conducted over the burning grounds at Site 1 during the confirmation study. The soil gas results are presented in the Interim RI and were used to direct the soil investigation during the RI.

The RI soil investigation at Site 1 included investigations for soil contaminated by VOCs, SVOCs, metals, and explosives and investigations for ash contaminated by metals and dioxins.

VOCs Detected in Soils

VOCs are the most widespread contaminants occurring in soils at ABL. This is particularly true at Site 1. Table 3-1 presents the VOC analytical data for the 111 soil samples collected at Site 1 and analyzed for select VOCs by the onsite mobile laboratory. Table 3-14 lists and defines all qualifiers used in the data tables. Sample numbers include the suffix "ON" indicating the sample was analyzed on site. Duplicate samples also are included in the table indicated by the suffix "DUPON."

The onsite mobile laboratory analyzed for seven VOCs. The compounds were:

- 1,1,1-trichloroethane (1,1,1-TCA)
- 1,1-dichloroethane (1,1-DCA)
- 1,1-dichloroethene (1,1-DCE)
- cis-1,2-dichloroethene (cis-1,2-DCE)
- methylene chloride (MC)
- trans-1,2-dichloroethene (trans-1,2-DCE)
- trichloroethene (TCE)

The compounds 1,1,1-TCA, TCE, and methylene chloride represent three of the four primary solvents used at ABL as indicated by the focused facility audit.

(UNITS IN UG/KG)

| | 1,1,1-TCA | | 1,1-DCA | | 1,1-DCE | | CIS-1,2-DCE | | MC | | TRANS-1,2-DCE | | TCE | |
|----------------|-----------|-----|---------|-----|---------|-----|-------------|-----|----|-----|---------------|-----|------|-----|
| HCS-BG-10N | 11 | UJC | 21 | UJC | 21 | UJC | 21 | UJC | 21 | UJC | 21 | UJC | 110 | JC |
| HCS-BG-20N | 9.5 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 100 | JC |
| HCS-BG-30N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 46 | JC |
| HCS-BG-40N | 16 | JC | 20 | UJC | 20 | UJC | 120 | JC | 20 | UJC | 20 | UJC | 1600 | JC |
| HCS-BG-50N | 50 | JC | 33 | JC | 19 | UJC | 130 | JC | 62 | JC | 19 | UJC | 2500 | JC |
| HCS-BG-60N | 10 | UJC | 20 | UJC | 20 | UJC | 220 | JC | 20 | UJC | 20 | UJC | 140 | JC |
| HCS-BG-70N | 9.5 | UJC | 19 | UJC | 19 | UJC | 390 | JC | 19 | UJC | 19 | UJC | 91 | JC |
| HCS-BG-80N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 500 | JC |
| HCS-BG-90N | 150 | JC | 20 | UJC | 23 | JC | 20 | UJC | 21 | JC | 20 | UJC | 6300 | JC |
| HCS-BG-100N | 9.5 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 280 | JC |
| HCS-BG-110N | 11 | UJC | 21 | UJC | 21 | UJC | 21 | UJC | 21 | UJC | 21 | UJC | 180 | JC |
| HCS-BG-120N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 88 | JC |
| HCS-BG-130N | 9.5 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 9.5 | UJC |
| HCS-BG-140N | 9.5 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 9.5 | UJC |
| HCS-BG-15DUPON | 9.6 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 110 | JC |
| HCS-BG-150N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 100 | JC |
| HCS-BG-160N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 200 | JC |
| HCS-BG-17DUPON | 9.4 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 130 | JC |
| HCS-BG-170N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 140 | JC |
| HCS-BG-180N | 35 | JC | 18 | UJC | 18 | UJC | 18 | UJC | 18 | UJC | 18 | UJC | 300 | JC |
| HCS-BG-190N | 10 | UJC | 21 | UJC | 21 | UJC | 21 | UJC | 21 | UJC | 21 | UJC | 10 | UJC |
| HCS-BG-200N | 9.7 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 9.7 | UJC |
| HCS-BG-210N | 9.5 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 9.5 | UJC |
| HCS-BG-220N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 10 | UJC |
| HCS-BG-230N | 10 | UJC | 21 | UJC | 21 | UJC | 26 | JC | 21 | UJC | 21 | UJC | 220 | JC |
| HCS-BG-24DUPON | 9.7 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 130 | JC |
| HCS-BG-240N | 9.7 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 130 | JC |
| HCS-BG-250N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 170 | JC |
| HCS-BG-260N | 9.2 | UJC | 18 | UJC | 18 | UJC | 18 | UJC | 18 | UJC | 18 | UJC | 130 | JC |
| HCS-BG-270N | 9.6 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 200 | JC |
| HCS-BG-280N | 9.5 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 30 | JC |
| HCS-BG-290N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 40 | JC |
| HCS-BG-300N | 9.1 | UJC | 18 | UJC | 18 | UJC | 18 | UJC | 18 | UJC | 18 | UJC | 110 | JC |
| HCS-BG-310N | 12 | JC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 120 | JC |
| HCS-BG-320N | 10 | UJC | 21 | JC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 30 | JC |
| HCS-BG-330N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 10 | UJC |

(UNITS IN UG/KG)

| | 1, 1, 1-TCA | | 1, 1-DCA | | 1, 1-DCE | | CIS-1, 2-DCE | | MC | | TRANS-1, 2-DCE | | TCE | |
|----------------|-------------|-----|----------|-----|----------|-----|--------------|-----|----|-----|----------------|-----|------|-----|
| HCS-BG-340N | 9.3 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 9.8 | JC |
| HCS-BG-350N | 9.4 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 13 | JC |
| HCS-BG-36DUPON | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 31 | JC |
| HCS-BG-360N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 37 | JC |
| HCS-BG-370N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 170 | JC |
| HCS-BG-380N | 120 | JC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 6100 | JC |
| HCS-BG-390N | 13 | JC | 18 | UJC | 18 | UJC | 18 | JC | 24 | JC | 18 | UJC | 820 | JC |
| HCS-BG-400N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 11 | JC |
| HCS-BG-410N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 30 | JC |
| HCS-BG-420N | 9.5 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 45 | JC |
| HCS-BG-430N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 150 | JC |
| HCS-BG-440N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 170 | JC |
| HCS-BG-450N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 38 | JC | 20 | UJC | 10 | UJC |
| HCS-BG-46DUPON | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 97 | JC |
| HCS-BG-460N | 9 | UJC | 18 | UJC | 18 | UJC | 18 | UJC | 18 | UJC | 18 | UJC | 92 | JC |
| HCS-BG-470N | 11 | UJC | 21 | UJC | 21 | UJC | 21 | UJC | 21 | UJC | 21 | UJC | 84 | JC |
| HCS-BG-48DUPON | 9 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 110 | JC |
| HCS-BG-480N | 9.8 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 110 | JC |
| HCS-BG-490N | 9.4 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 41 | JC |
| HCS-BG-500N | 9.6 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 23 | JC |
| HCS-BG-51DUPON | 9.2 | UJC | 18 | UJC | 18 | UJC | 18 | UJC | 18 | UJC | 18 | UJC | 52 | JC |
| HCS-BG-510N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 58 | JC |
| HCS-BG-520N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 290 | JC |
| HCS-BG-530N | 33 | JC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 400 | JC |
| HCS-BG-540N | 10 | JC | 19 | JC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 340 | JC |
| HCS-BG-550N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 120 | JC |
| HCS-BG-560N | 9.8 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 250 | JC |
| HCS-BG-570N | 9.4 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 22 | JC |
| HCS-BG-580N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 48 | JC |
| HCS-BG-590N | 9.6 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 25 | JC |
| HCS-BG-600N | 9.8 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 9.8 | UJC |
| HCS-BG-610N | 9.8 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 15 | JC |
| HCS-BG-620N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 12 | JC |
| HCS-BG-630N | 9.3 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 170 | JC |
| HCS-BG-640N | 23 | JC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 310 | JC |
| HCS-BG-650N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 15 | JC |

TABLE 3-1
SITE 1
VOC ANALYSIS OF SOIL SAMPLES BY THE ONSITE MOBILE LABORATORY
(UNITS IN UG/KG)

| | 1,1,1-TCA | | 1,1-DCA | | 1,1-DCE | | CIS-1,2-DCE | | MC | | TRANS-1,2-DCE | | TCE | |
|----------------|-----------|-----|---------|-----|---------|-----|-------------|-----|----|-----|---------------|-----|-------|-----|
| HCS-BG-660N | 9.8 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 310 | JC |
| HCS-BG-67DUPON | 9.8 | UJC | 20 | UJC | 20 | UJC | 93 | JC | 20 | UJC | 20 | UJC | 90 | JC |
| HCS-BG-670N | 9.6 | UJC | 19 | UJC | 19 | UJC | 95 | UJC | 19 | UJC | 19 | UJC | 90 | JC |
| HCS-BG-68DUPON | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 110 | JC |
| HCS-BG-680N | 10 | UJC | 20 | UJC | 20 | UJC | 780 | JC | 20 | UJC | 20 | UJC | 160 | JC |
| HCS-BG-690N | 9.1 | UJC | 18 | UJC | 18 | UJC | 18 | UJC | 18 | UJC | 18 | UJC | 72 | JC |
| HCS-BG-700N | 9.7 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 110 | JC |
| HCS-BG-710N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 40 | JC |
| HCS-BG-720N | 9.1 | UJC | 18 | UJC | 18 | UJC | 18 | UJC | 18 | UJC | 18 | UJC | 73 | JC |
| HCS-BG-730N | 11 | JC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 170 | JC |
| HCS-BG-740N | 16 | JC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 260 | JC |
| HCS-BG-750N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 230 | JC |
| HCS-BG-760N | 9.4 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 220 | JC |
| HCS-BG-770N | 9.3 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | JC |
| HCS-BG-780N | 9.8 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 65 | JC |
| HCS-BG-790N | 9.6 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 400 | JC |
| HCS-BG-800N | 20 | JC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 240 | JC |
| HCS-BG-810N | 9.1 | UJC | 18 | UJC | 18 | UJC | 18 | UJC | 18 | UJC | 18 | UJC | 25 | JC |
| HCS-BG-820N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 10 | UJC |
| HCS-BG-830N | 9.5 | UJC | 19 | UJC | 19 | UJC | 86 | JC | 19 | UJC | 19 | UJC | 190 | JC |
| HCS-BG-840N | 9.5 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 370 | JC |
| HCS-BG-850N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | JC |
| HCS-BG-860N | 9.6 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 54 | JC |
| HCS-BG-870N | 9.3 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 9.3 | UJC |
| HCS-BG-880N | 9.5 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 9.5 | UJC |
| HCS-BG-89DUPON | 9.5 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | JC |
| HCS-BG-890N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 24 | JC |
| HCS-BG-92DUPON | 9.3 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 110 | JC |
| HCS-BG-920N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 130 | JC |
| HCS-BG-930N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 35 | JC |
| HCS-BG-940N | 9.6 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 9.6 | UJC |
| HCS-BG-950N | 14 | JC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 9.8 | UJC |
| HCS-BG-960N | 170 | JC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 10 | UJC |
| HCS-BG-970N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 13 | JC |
| HCS-BG-980N | 82 | JC | 20 | UJC | 20 | UJC | 62 | JC | 20 | UJC | 20 | UJC | 16000 | JC |
| HCS-BG-990N | 10 | UJC | 21 | UJC | 21 | UJC | 66 | JC | 21 | UJC | 21 | UJC | 27 | JC |

TABLE 3-1
SITE 1
VOC ANALYSIS OF SOIL SAMPLES BY THE ONSITE MOBILE LABORATORY
(UNITS IN UG/KG)

| | 1,1,1-TCA | | 1,1-DCA | | 1,1-DCE | | CIS-1,2-DCE | | MC | | TRANS-1,2-DCE | | TCE | |
|--------------|-----------|-----|---------|-----|---------|-----|-------------|-----|----|-----|---------------|-----|------|-----|
| HCS-BG-1000N | 9.6 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 22 | JC |
| HCS-BG-1010N | 11 | UJC | 21 | UJC | 21 | UJC | 21 | UJC | 21 | UJC | 21 | UJC | 61 | JC |
| HCS-BG-1020N | 10 | UJC | 20 | UJC | 20 | UJC | 170 | JC | 20 | UJC | 20 | UJC | 8600 | JC |
| HCS-BG-1030N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 180 | JC |
| HCS-BG-1040N | 10 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 20 | UJC | 10 | UJC |
| HCS-BG-1050N | 9.3 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 20 | JC |
| HCS-BG-1060N | 9.7 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 400 | JC |
| HCS-BG-1070N | 9.5 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 19 | UJC | 48 | JC |
| HCS-BG-1080N | 9.7 | UJC | 19 | UJC | 19 | UJC | 60 | JC | 19 | UJC | 19 | UJC | 710 | JC |
| HCS-BG-1090N | 11 | UJC | 21 | UJC | 21 | UJC | 300 | JC | 21 | UJC | 21 | UJC | 280 | JC |
| HCS-BG-1100N | 10 | UJC | 20 | UJC | 20 | UJC | 3100 | JC | 20 | UJC | 160 | JC | 1400 | JC |
| HCS-BG-1110N | 9.5 | UJC | 19 | UJC | 19 | UJC | 57 | JC | 19 | UJC | 19 | UJC | 200 | JC |
| HCS-BG-1120N | 9.8 | UJC | 20 | UJC | 20 | UJC | 68 | UJC | 20 | UJC | 20 | UJC | 98 | JC |
| HCS-BG-1130N | 215 | JC | 20 | UJC | 20 | UJC | 350 | JC | 20 | UJC | 20 | UJC | 2300 | JC |

Table 3-2 presents a statistical analysis of the data for soil samples analyzed by the onsite mobile laboratory. Sample duplicates are not included in the statistical analysis. Figure 3-1 shows the sampling locations and Table 3-3 lists the sample depths. TCE is the most prevalent compound, having been detected in 95 of the 111 samples analyzed or 86 percent of the samples. The concentration of TCE detected in soil samples ranged from 5 to 16,000 $\mu\text{g}/\text{kg}$. A value equal to one-half the CLP detection limit was entered for all non-detects. The arithmetic mean of TCE detected in the 111 samples is roughly 500 $\mu\text{g}/\text{kg}$. However, the standard deviation for TCE is almost four times the arithmetic mean, indicating a wide range of TCE concentrations.

Both 1,1,1-TCA and cis-1,2-DCE were detected in approximately 15 percent of the samples. 1,1,1-TCA concentrations ranged from 5 $\mu\text{g}/\text{kg}$ to 215 $\mu\text{g}/\text{kg}$. In addition, 15 of the 17 samples in which 1,1,1-TCA was detected contained considerably higher concentrations of TCE. The other two samples, HCS-BG-95ON and HCS-BG-96ON, contained 1,1,1-TCA concentrations of 14 $\mu\text{g}/\text{kg}$ and 170 $\mu\text{g}/\text{kg}$, respectively. Twelve of the 15 samples in which cis-1,2-DCE was detected contained approximately equal or higher concentrations of TCE. Samples HCS-BG-6ON, HCS-BG-70ON, HCS-BG-68ON, and HCS-BG-99ON contained cis-1,2-DCE concentrations of 220 $\mu\text{g}/\text{kg}$, 390 $\mu\text{g}/\text{kg}$, 780 $\mu\text{g}/\text{kg}$, and 66 $\mu\text{g}/\text{kg}$, respectively. The remaining four compounds analyzed for were detected in less than 5 of the 111 samples.

The results of the VOC analysis for all soil samples analyzed by the offsite laboratory are presented in Appendix A of the Draft RI report. Table 3-4 shows the VOCs detected for the 21 soil samples analyzed by the onsite mobile laboratory and the offsite laboratory. Samples analyzed by the offsite laboratory do not include the suffix "ON" but are labeled with the same number. For example, samples HCS-BG-3 and HCS-BG-3ON were both collected from sample location HCS-BG-3. Sample HCS-BG-3ON was analyzed by the onsite mobile laboratory and sample HCS-BG-3 was analyzed by the offsite laboratory.

The offsite laboratory analyzed for all VOCs included on the target compound list (TCL). Two of the compounds analyzed by the mobile laboratory (cis-1,2-DCE and trans-1,2-DCE) are not included on the EPA TCL. However, 1,2-DCE (total), which is simply the sum of cis-1,2-DCE and trans-1,2-DCE, is included.

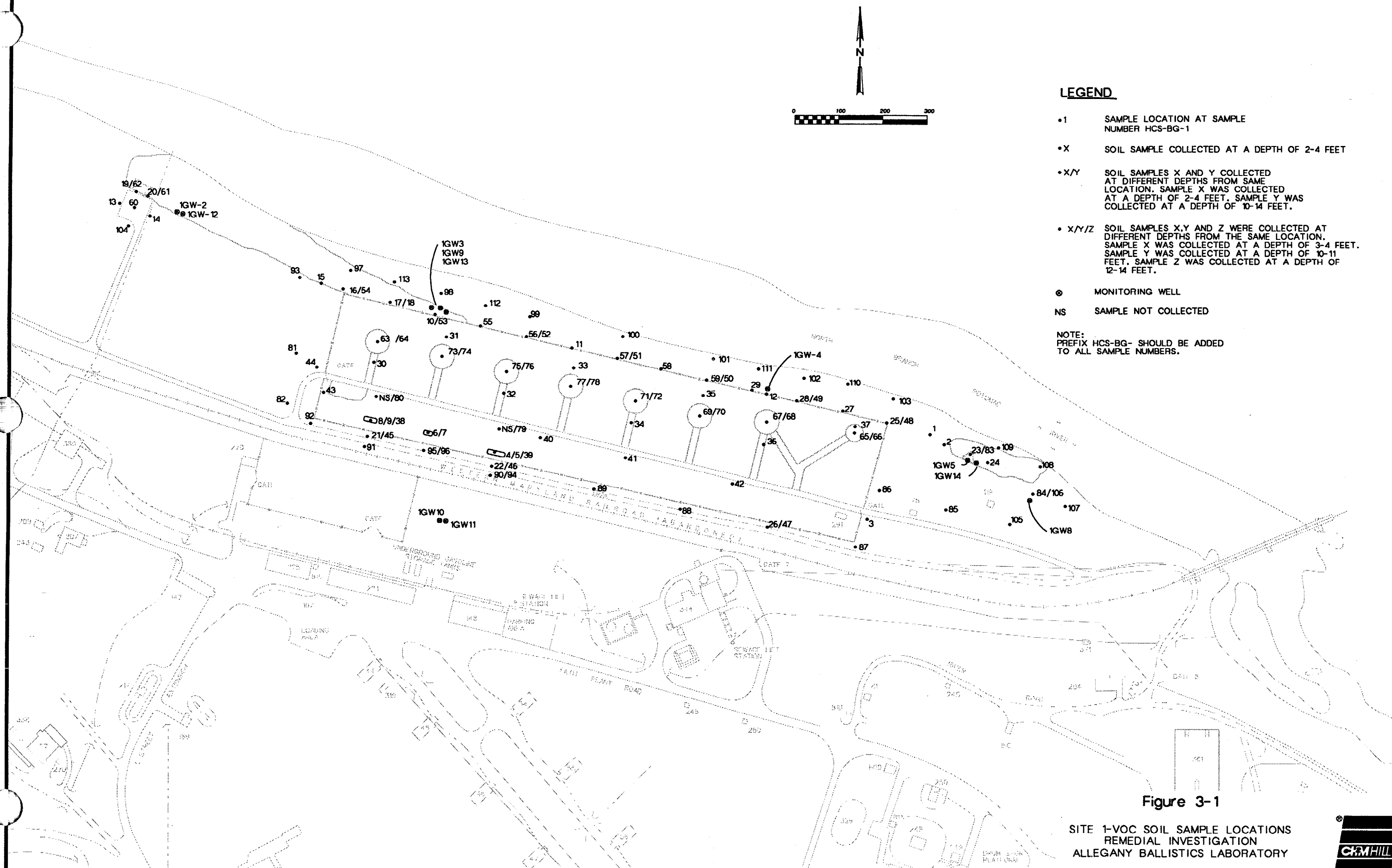
A few general observations can be made when comparing data for samples analyzed by the onsite mobile laboratory with data for split samples analyzed by the offsite laboratory. Very few inconsistencies exist in the data for the seven compounds analyzed by the mobile laboratory, with the exception of TCE. This can be attributed to the compounds not being detected and the detection limit used by the offsite laboratory often being much higher than the detection limit used by the onsite mobile laboratory.

Analytical results for TCE generated by the two labs show little agreement. However, two trends were observed. Concentrations in samples analyzed by the onsite mobile laboratory tend to be higher than concentrations analyzed by the offsite laboratory. This is especially true for soil samples with levels of TCE (10 to 400 $\mu\text{g}/\text{kg}$). The discrepancies may result

TABLE 3-2
SITE 1 - STATISTICAL ANALYSIS OF
ANALYTICAL DATA FOR SOIL SAMPLES ANALYZED BY THE ONSITE MOBILE LABORATORY

| | Maximum Concentration | Minimum Concentration | Standard Deviation | Arithmetic Mean | Frequency | Detected Count | Total Count |
|----------------------------------|--------------------------|--------------------------|-----------------------|--------------------|-----------|-------------------|----------------|
| VOLATILE ORGANICS (UG/KG) | | | | | | | |
| 1,1,1-TRICHLOROETHANE | 215 | 5 | 31.5 | 13.2 | 0.15 | 17 | 111 |
| 1,1-DICHLOROETHANE | 33 | 5 | 3.3 | 5.5 | 0.03 | 3 | 111 |
| 1,1-DICHLOROETHENE | 23 | 5 | 1.7 | 5.2 | 0.01 | 1 | 111 |
| CIS-1,2-DICHLOROETHENE | 3100 | 10.5 | 305.9 | 62.5 | 0.14 | 16 | 111 |
| METHYLENE CHLORIDE | 62 | 5 | 6.7 | 6.3 | 0.05 | 5 | 111 |
| TRANS-1,2-DICHLOROETHENE | 160 | 10.5 | 14.2 | 11.8 | 0.01 | 1 | 111 |
| TRICHLOROETHENE | 16000 | 5 | 1899.2 | 518.8 | 0.86 | 95 | 111 |

Note: A value equal to one-half the detection limit was entered for all non-detects.



00396605Z

Table 3-3
SITE 1 SOIL SAMPLE DEPTHS

| Sample Number | Depth (Feet) | Sample Number | Depth (Feet) | Sample Number | Depth (Feet) | Sample Number | Depth (Feet) |
|----------------------|---------------------|----------------------|---------------------|----------------------|---------------------|----------------------|---------------------|
| HCS-BG-1 | 3-4 | HCS-BG-2 | 3-4 | HCS-BG-3* | 3-4 | HCS-BG-4* | 3-4 |
| HCS-BG-5* | 10-11 | HCS-BG-6* | 3-4 | HCS-BG-7 | 10-11 | HCS-BG-8 | 3-4 |
| HCS-BG-9 | 10-11 | HCS-BG-10* | 3-4 | HCS-BG-11 | 3-4 | HCS-BG-12 | 3-4 |
| HCS-BG-13 | 3-4 | HCS-BG-14 | 3-4 | HCS-BG-15* | 3-4 | HCS-BG-16 | 3-4 |
| HCS-BG-17 | 3-4 | HCS-BG-18* | 10-11 | HCS-BG-19 | 3-4 | HCS-BG-20 | 3-4 |
| HCS-BG-21 | 3-4 | HCS-BG-22 | 3-4 | HCS-BG-23 | 3-4 | HCS-BG-24 | 3-4 |
| HCS-BG-25 | 3-4 | HCS-BG-26 | 3-4 | HCS-BG-27 | 3-4 | HCS-BG-28 | 3-4 |
| HCS-BG-29 | 3-4 | HCS-BG-30 | 3-4 | HCS-BG-31 | 3-4 | HCS-BG-32 | 3-4 |
| HCS-BG-33 | 3-4 | HCS-BG-34* | 3-4 | HCS-BG-35 | 3-4 | HCS-BG-36 | 3-4 |
| HCS-BG-37* | 3-4 | HCS-BG-38* | 12.5-13.5 | HCS-BG-39 | 12.5-13.5 | HCS-BG-40 | 3-4 |
| HCS-BG-41 | 3-4 | HCS-BG-42 | 3-4 | HCS-BG-43 | 3-4 | HCS-BG-44 | 3-4 |
| HCS-BG-45 | 12-13 | HCS-BG-46 | 11-12 | HCS-BG-47 | 11-12 | HCS-BG-48 | 11-12 |
| HCS-BG-49 | 11-12 | HCS-BG-50* | 11-12 | HCS-BG-51 | 12-13 | HCS-BG-52 | 12-13 |
| HCS-BG-53* | 13-14 | HCS-BG-54 | 13-14 | HCS-BG-55 | 3-4 | HCS-BG-56 | 3-4 |
| HCS-BG-57 | 3-4 | HCS-BG-58 | 3-4 | HCS-BG-59 | 3-4 | HCS-BG-60 | 3-4 |
| HCS-BG-61 | 10-11 | HCS-BG-62 | 10-11 | HCS-BG-63 | 3-4 | HCS-BG-64 | 10-11 |
| HCS-BG-65 | 3-4 | HCS-BG-66 | 11-12 | HCS-BG-67 | 3-4 | HCS-BG-68* | 11-12 |

Table 3-3
SITE 1 SOIL SAMPLE DEPTHS

| Sample Number | Depth (Feet) | Sample Number | Depth (Feet) | Sample Number | Depth (Feet) | Sample Number | Depth (Feet) |
|----------------------|---------------------|----------------------|---------------------|----------------------|---------------------|----------------------|---------------------|
| HCS-BG-69 | 3-4 | HCS-BG-70 | 11-12 | HCS-BG-71 | 3-4 | HCS-BG-72 | 11-12 |
| HCS-BG-73 | 3-4 | HCS-BG-74 | 10-11 | HCS-BG-75 | 3-4 | HCS-BG-76 | 11-12 |
| HCS-BG-77 | 3-4 | HCS-BG-78 | 11-12 | HCS-BG-79* | 11-12 | HCS-BG-80 | 10-11 |
| HCS-BG-81 | 3-4 | HCS-BG-82 | 3-4 | HCS-BG-83 | 11-12 | HCS-BG-84* | 3-4 |
| HCS-BG-85 | 3-4 | HCS-BG-86 | 3-4 | HCS-BG-87 | 3-4 | HCS-BG-88 | 3-4 |
| HCS-BG-89 | 3-4 | HCS-BG-90 | 3-4 | HCS-BG-91 | 3-4 | HCS-BG-92 | 3-4 |
| HCS-BG-93 | 3-4 | HCS-BG-94 | 11-12 | HCS-BG-95 | 3-4 | HCS-BG-96 | 11-12 |
| HCS-BG-97 | 2-3 | HCS-BG-98 | 2-3 | HCS-BG-99* | 2-3 | HCS-BG-100 | 2-3 |
| HCS-BG-101 | 2 | HCS-BG-102* | 2 | HCS-BG-103 | 2-3 | HCS-BG-104 | 3-4 |
| HCS-BG-105 | 3-4 | HCS-BG-106* | 11-12 | HCS-BG-107 | 3-4 | HCS-BG-108 | 2 |
| HCS-BG-109 | 2-3 | HCS-BG-110* | 2-3 | HCS-BG-111 | 2 | HCS-BG-112* | 2-3 |
| HCS-BG-113* | 2-3 | HCS-BP-1 | 0.5-1 | HCS-BP-2 | 0.5-1 | HCS-BP-3 | 0.5-1 |
| HCS-BP-4 | 0.5-1 | HCS-BP-5 | 0.5-1 | HCS-BP-6 | 0.5-1 | HCS-BP-7 | 0.5-1 |
| HCS-BP-8 | 0.5-1 | HCS-B1-1-3 | 3 | HCS-B1-1-6 | 6 | HCS-B1-2-S | 0.5-1 |
| HCS-B1-2-2 | 2 | HCS-B1-3-S | 0.5-1 | HCS-B1-3-1 | 1-2 | HCS-B1-4-S | 0.5-1 |
| HCS-B1-5-S | 0.5-1 | HCS-B1-5-1 | 1-2 | HCS-B1-6-S | 0.5-1 | HCS-B1-6-1 | 1-2 |
| HCS-B1-7-S | 0.5-1 | HCS-B1-7-1 | 1-2 | HCS-B1-8-S | 0.5-1 | HCS-B1-8-2 | 2-3 |

| Sample Number | Depth (Feet) | Sample Number | Depth (Feet) | Sample Number | Depth (Feet) | Sample Number | Depth (Feet) |
|---------------|--------------|---------------|--------------|---------------|--------------|---------------|--------------|
| HCS-B1-9-S | 0.5-1 | HCS-B1-9-2 | 2-3 | HCS-B1-10-S | 0.5-1 | HCS-B1-10-5 | 5 |
| HCS-B1-11-S | 0.5-1 | HCS-B1-11-5 | 5 | HCS-B2-1-2 | 2 | HCS-B2-1-3 | 3 |
| HCS-B2-2-S | 3 | HCS-B2-2-4 | 4 | HCS-B2-3-S | 3 | HCS-B2-3-4 | 4 |
| HCS-B2-4-S | 3 | HCS-B2-4-4 | 4 | HCS-B2-5-S | 2 | HCS-B2-5-3 | 3 |
| HCS-B2-6-S | 2 | HCS-B2-6-3 | 3 | HCS-B2-7-S | 2 | HCS-B2-7-3 | 3 |
| HCS-B2-8-S | 2-3 | HCS-B2-9-S | 3 | HCS-B2-9-4 | 4 | HCS-B2-10-S | 5 |
| HCS-B2-10-6 | 6 | | | | | | |

* Split sample sent for offsite VOC analysis.

* Split sample sent for offsite VOC analysis.

TABLE
SITE 1
VOCs DETECTED IN SOIL SAMPLES ANALYZED BY ONSITE MOBILE LABORATORY
AND OFFSITE LABORATORY
(UNITS IN UG/KG)

| | HCS-BG-3 | | HCS-BG-30N | | HCS-BG-4 | | HCS-BG-40N | | HCS-BG-5 | |
|----------------------------|------------|-----|----------------|-----|-------------|-----|------------|-----|-------------|-----|
| 1,1,1-TRICHLOROETHANE | 6 | UJC | 10 | UJC | 730 | U | 16 | JC | 4500 | U |
| 1,1-DICHLOROETHANE | 6 | UJS | 20 | UJC | 730 | U | 20 | UJC | 4500 | U |
| 1,1-DICHLOROETHENE | 6 | UJS | 20 | UJC | 730 | U | 20 | UJC | 4500 | U |
| 1,2-DICHLOROETHENE (TOTAL) | 6 | UJS | | JC | 730 | U | | JC | 4500 | U |
| 2-BUTANONE | 12 | UJS | | JC | 1500 | U | | JC | 8900 | U |
| ACETONE | 12 | UJB | | JC | 1900 | UJB | | JC | 8900 | U |
| CARBON DISULFIDE | 6 | UJS | | JC | 730 | U | | JC | 4500 | U |
| TETRACHLOROETHENE | 6 | UJS | | JC | 730 | U | | JC | 4500 | U |
| TOLUENE | 6 | UJS | | JC | 730 | U | | JC | 4500 | U |
| TRICHLOROETHENE | 8 | JES | 46 | JC | 3800 | | 1600 | JC | 76000 | JE |
| XYLENES (TOTAL) | 2 | JS | | JC | 290 | J | | JC | 4500 | U |
| | | | | | | | | | | |
| | HCS-BG-50N | | HCS-BG-6 | | HCS-BG-60N | | HCS-BG-10 | | HCS-BG-100N | |
| 1,1,1-TRICHLOROETHANE | 50 | JC | 6 | UJS | 10 | UJC | 6 | UJC | 9.5 | UJC |
| 1,1-DICHLOROETHANE | 33 | JC | 6 | UJS | 20 | UJC | 6 | UJS | 19 | UJC |
| 1,1-DICHLOROETHENE | 19 | UJC | 6 | UJS | 20 | UJC | 6 | UJS | 19 | UJC |
| 1,2-DICHLOROETHENE (TOTAL) | | JC | 6 | UJS | | JC | 6 | UJS | | JC |
| 2-BUTANONE | | JC | 12 | UJS | | JC | 11 | UJS | | JC |
| ACETONE | | JC | 12 | UJB | | JC | 11 | UJB | | JC |
| CARBON DISULFIDE | | JC | 6 | UJS | | JC | 6 | UJS | | JC |
| TETRACHLOROETHENE | | JC | 6 | UJS | | JC | 6 | UJS | | JC |
| TOLUENE | | JC | 6 | UJS | | JC | 6 | UJS | | JC |
| TRICHLOROETHENE | 2500 | JC | 5 | JES | 140 | JC | 5 | JES | 280 | JC |
| XYLENES (TOTAL) | | JC | 2 | JS | | JC | 2 | JS | | JC |
| | | | | | | | | | | |
| | HCS-BG-15 | | HCS-BG-15DUPON | | HCS-BG-150N | | HCS-BG-18 | | HCS-BG-180N | |
| 1,1,1-TRICHLOROETHANE | 6 | UJC | 9.6 | UJC | 10 | UJC | 6 | UJC | 35 | JC |
| 1,1-DICHLOROETHANE | 6 | UJS | 19 | UJC | 20 | UJC | 6 | UJS | 18 | UJC |
| 1,1-DICHLOROETHENE | 6 | UJS | 19 | UJC | 20 | UJC | 6 | UJS | 18 | UJC |
| 1,2-DICHLOROETHENE (TOTAL) | 6 | UJS | | JC | | JC | 6 | UJS | | JC |
| 2-BUTANONE | 11 | UJS | | JC | | JC | 12 | UJC | | JC |
| ACETONE | 11 | UJB | | JC | | JC | 8 | UJB | | JC |
| CARBON DISULFIDE | 2 | JS | | JC | | JC | 6 | UJS | | JC |
| TETRACHLOROETHENE | 6 | UJS | | JC | | JC | 6 | UJS | | JC |
| TOLUENE | 6 | UJS | | JC | | JC | 6 | UJS | | JC |
| TRICHLOROETHENE | 26 | JES | 110 | JC | 100 | JC | 48 | JES | 300 | JC |
| XYLENES (TOTAL) | 2 | JS | | JC | | JC | 3 | JS | | JC |

TABLE
SITE 1
VOCs DETECTED IN SOIL SAMPLES ANALYZED BY ONSITE MOBILE LABORATORY
AND OFFSITE LABORATORY
(UNITS IN UG/KG)

| | HCS-BG-34 | | HCS-BG-34ON | | HCS-BG-37 | | HCS-BG-37ON | | HCS-BG-38 | |
|----------------------------|-------------|-----|-------------|-----|-------------|-----|-------------|-----|-----------|-----|
| 1,1,1-TRICHLOROETHANE | 6 | UJC | 9.3 | UJC | 6 | UJC | 10 | UJC | 260 | J |
| 1,1-DICHLOROETHANE | 6 | UJS | 19 | UJC | 6 | UJS | 20 | UJC | 740 | U |
| 1,1-DICHLOROETHENE | 6 | UJS | 19 | UJC | 6 | UJS | 20 | UJC | 740 | U |
| 1,2-DICHLOROETHENE (TOTAL) | 6 | UJS | | JC | 6 | UJS | | JC | 740 | U |
| 2-BUTANONE | 12 | UJS | | JC | 12 | UJS | | JC | 1500 | U |
| ACETONE | 13 | UJB | | JC | 18 | UJB | | JC | 1500 | U |
| CARBON DISULFIDE | 6 | UJS | | JC | 2 | JS | | JC | 740 | U |
| TETRACHLOROETHENE | 6 | UJS | | JC | 3 | JS | | JC | 330 | J |
| TOLUENE | 6 | UJS | | JC | 6 | UJS | | JC | 170 | J |
| TRICHLOROETHENE | 1 | JES | 9.8 | JC | 37 | JS | 170 | JC | 48000 | JE |
| XYLENES (TOTAL) | 6 | UJS | | JC | 6 | UJS | | JC | 190 | J |
| | | | | | | | | | | |
| | HCS-BG-38DL | | HCS-BG-38ON | | HCSD-BG-4 | | HCSD-BG-4DL | | HCS-BG-50 | |
| 1,1,1-TRICHLOROETHANE | 1500 | U | 120 | JC | 760 | U | 11000 | U | 6 | UJC |
| 1,1-DICHLOROETHANE | 1500 | U | 20 | UJC | 760 | U | 11000 | U | 6 | UJS |
| 1,1-DICHLOROETHENE | 1500 | U | 20 | UJC | 760 | U | 11000 | U | 6 | UJS |
| 1,2-DICHLOROETHENE (TOTAL) | 1500 | U | | JC | 760 | U | 11000 | U | 6 | UJS |
| 2-BUTANONE | 3000 | U | | JC | 1500 | U | 30000 | D | 11 | UJC |
| ACETONE | 1400 | DJ | | JC | 1500 | UJB | 15000 | DJ | 18 | UJB |
| CARBON DISULFIDE | 1500 | U | | JC | 760 | U | 11000 | U | 6 | UJS |
| TETRACHLOROETHENE | 370 | DJ | | JC | 740 | J | 11000 | U | 6 | UJS |
| TOLUENE | 1500 | U | | JC | 660 | J | 11000 | U | 6 | UJS |
| TRICHLOROETHENE | 42000 | D | 6100 | JC | 160000 | JE | 160000 | D | 2 | JES |
| XYLENES (TOTAL) | 1500 | U | | JC | 1700 | | 11000 | U | 4 | JS |
| | | | | | | | | | | |
| | HCS-BG-50ON | | HCS-BG-53 | | HCS-BG-53DL | | HCS-BG-53ON | | HCS-BG-68 | |
| 1,1,1-TRICHLOROETHANE | 9.6 | UJC | 5 | JJC | 5 | DJ | 33 | JC | 6 | UJC |
| 1,1-DICHLOROETHANE | 19 | UJC | 6 | UJS | 12 | U | 20 | UJC | 6 | UJS |
| 1,1-DICHLOROETHENE | 19 | UJC | 6 | UJS | 12 | U | 20 | UJC | 6 | UJS |
| 1,2-DICHLOROETHENE (TOTAL) | | JC | 26 | JS | 16 | D | | JC | 6 | UJS |
| 2-BUTANONE | | JC | 12 | UJC | 25 | U | | JC | 11 | UJC |
| ACETONE | | JC | 15 | UJB | 25 | D | | JC | 11 | UJB |
| CARBON DISULFIDE | | JC | 6 | UJS | 12 | U | | JC | 6 | UJS |
| TETRACHLOROETHENE | | JC | 6 | UJS | 12 | U | | JC | 12 | PS |
| TOLUENE | | JC | 6 | UJS | 12 | U | | JC | 6 | UJS |
| TRICHLOROETHENE | 23 | JC | 480 | JE | 480 | D | 400 | JC | 30 | |
| XYLENES (TOTAL) | | JC | 6 | UJS | 12 | U | | JC | 6 | UJS |

TABLE
SITE 1

VOCs DETECTED IN SOIL SAMPLES ANALYZED BY ONSITE MOBILE LABORATORY
AND OFFSITE LABORATORY
(UNITS IN UG/KG)

| | HCS-BG-68DUPON | | HCS-BG-68ON | | HCS-BG-79 | | HCS-BG-79DL | | HCS-BG-79ON | |
|----------------------------|----------------|-----|--------------|-----|------------|-----|--------------|-----|-------------|-----|
| 1,1,1-TRICHLOROETHANE | 10 | UJC | 10 | UJC | 6 | UJC | 17 | U | 9.6 | UJC |
| 1,1-DICHLOROETHANE | 20 | UJC | 20 | UJC | 6 | UJS | 17 | U | 19 | UJC |
| 1,1-DICHLOROETHENE | 20 | UJC | 20 | UJC | 6 | UJS | 17 | U | 19 | UJC |
| 1,2-DICHLOROETHENE (TOTAL) | | JC | | JC | 6 | UJS | 17 | U | | JC |
| 2-BUTANONE | | JC | | JC | 12 | UJC | 34 | U | | JC |
| ACETONE | | JC | | JC | 8 | UJB | 15 | BDJ | | JC |
| CARBON DISULFIDE | | JC | | JC | 6 | UJS | 17 | U | | JC |
| TETRACHLOROETHENE | | JC | | JC | 6 | UJS | 17 | U | | JC |
| TOLUENE | | JC | | JC | 6 | UJS | 17 | U | | JC |
| TRICHLOROETHENE | 110 | JC | 160 | JC | 430 | JES | 380 | D | 400 | JC |
| XYLENES (TOTAL) | | JC | | JC | 6 | UJS | 17 | U | | JC |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | HCS-BG-84 | | HCS-BG-84ON | | HCS-BG-99 | | HCS-BG-99ON | | HCS-BG-99R | |
| 1,1,1-TRICHLOROETHANE | 6 | U | 9.5 | UJC | 6 | UJS | 10 | UJC | 6 | U |
| 1,1-DICHLOROETHANE | 6 | U | 19 | UJC | 6 | UJS | 21 | UJC | 6 | U |
| 1,1-DICHLOROETHENE | 6 | U | 19 | UJC | 6 | UJS | 21 | UJC | 6 | U |
| 1,2-DICHLOROETHENE (TOTAL) | 6 | U | | JC | 6 | UJS | | JC | 6 | U |
| 2-BUTANONE | 12 | U | | JC | 13 | UJS | | JC | 13 | U |
| ACETONE | 12 | U | | JC | 13 | UJS | | JC | 13 | U |
| CARBON DISULFIDE | 6 | U | | JC | 3 | JS | | JC | 6 | U |
| TETRACHLOROETHENE | 6 | U | | JC | 6 | UJS | | JC | 6 | U |
| TOLUENE | 6 | U | | JC | 6 | UJS | | JC | 6 | U |
| TRICHLOROETHENE | 100 | JE | 370 | JC | 8 | JE | 27 | JC | 5 | J |
| XYLENES (TOTAL) | 6 | U | | JC | 6 | UJS | | JC | 6 | U |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | HCS-BG-102 | | HCS-BG-102ON | | HCS-BG-106 | | HCS-BG-106ON | | HCS-BG-110 | |
| 1,1,1-TRICHLOROETHANE | 880 | U | 10 | UJC | 750 | U | 9.7 | UJC | 820 | U |
| 1,1-DICHLOROETHANE | 880 | U | 20 | UJC | 750 | U | 19 | UJC | 820 | U |
| 1,1-DICHLOROETHENE | 880 | U | 20 | UJC | 750 | U | 19 | UJC | 820 | U |
| 1,2-DICHLOROETHENE (TOTAL) | 260 | J | | JC | 750 | U | | JC | 27000 | |
| 2-BUTANONE | 1800 | U | | JC | 1500 | U | | JC | 1400 | J |
| ACETONE | 1800 | U | | JC | 430 | J | | JC | 1600 | U |
| CARBON DISULFIDE | 880 | U | | JC | 750 | U | | JC | 820 | U |
| TETRACHLOROETHENE | 1400 | | | JC | 750 | U | | JC | 820 | U |
| TOLUENE | 880 | U | | JC | 750 | U | | JC | 820 | U |
| TRICHLOROETHENE | 25000 | JE | 8600 | JC | 2500 | JE | 400 | JC | 3700 | JE |
| XYLENES (TOTAL) | 880 | U | | JC | 750 | U | | JC | 820 | U |

TABLE
SITE 1
VOCs DETECTED IN SOIL SAMPLES ANALYZED BY ONSITE MOBILE LABORATORY
AND OFFSITE LABORATORY
(UNITS IN UG/KG)

| | HCS-BG-110DL | | HCS-BG-110ON | | HCS-BG-112 | | HCS-BG-112ON | | HCS-BG-112R | |
|----------------------------|--------------|-----|--------------|-----|--------------|-----|--------------|-----|-------------|-----|
| 1,1,1-TRICHLOROETHANE | 1600 | U | 10 | UJC | 7 | UJS | 9.8 | UJC | 7 | UJS |
| 1,1-DICHLOROETHANE | 1600 | U | 20 | UJC | 7 | UJS | 20 | UJC | 7 | UJS |
| 1,1-DICHLOROETHENE | 1600 | U | 20 | UJC | 7 | UJS | 20 | UJC | 7 | UJS |
| 1,2-DICHLOROETHENE (TOTAL) | 24000 | D | | JC | 33 | JS | | JC | 7 | UJS |
| 2-BUTANONE | 3100 | BDJ | | JC | 13 | UJS | | JC | 13 | UJS |
| ACETONE | 1800 | DJ | | JC | 13 | UJC | | JC | 24 | JC |
| CARBON DISULFIDE | 1600 | U | | JC | 6 | JS | | JC | 2 | JS |
| TETRACHLOROETHENE | 1600 | U | | JC | 7 | UJS | | JC | 7 | UJS |
| TOLUENE | 1600 | U | | JC | 7 | UJS | | JC | 7 | UJS |
| TRICHLOROETHENE | 34000 | D | 1400 | JC | 56 | JES | 98 | JC | 14 | JES |
| XYLENES (TOTAL) | 1600 | U | | JC | 6 | JS | | JC | 7 | UJS |
| | | | | | | | | | | |
| | HCS-D-BG-112 | | HCS-BG-113 | | HCS-BG-113DL | | HCS-BG-113ON | JC | | |
| 1,1,1-TRICHLOROETHANE | 7 | U | 410 | J | 3500 | U | 215 | JC | | |
| 1,1-DICHLOROETHANE | 7 | U | 880 | U | 3500 | U | 20 | UJC | | |
| 1,1-DICHLOROETHENE | 7 | U | 880 | U | 3500 | U | 20 | UJC | | |
| 1,2-DICHLOROETHENE (TOTAL) | 7 | U | 880 | U | 3500 | U | | JC | | |
| 2-BUTANONE | 13 | U | 1800 | U | 9200 | BD | | JC | | |
| ACETONE | 13 | UJB | 820 | J | 5800 | DJ | | JC | | |
| CARBON DISULFIDE | 2 | J | 880 | U | 3500 | U | | JC | | |
| TETRACHLOROETHENE | 7 | U | 880 | U | 3500 | U | | JC | | |
| TOLUENE | 7 | U | 880 | U | 3500 | U | | JC | | |
| TRICHLOROETHENE | 11 | JE | 97000 | JE | 94000 | D | 2300 | JC | | |
| XYLENES (TOTAL) | 7 | U | 880 | U | 3500 | U | | JC | | |

from volatilization through increased handling. The opposite is true for samples with high concentrations of TCE. For samples containing high concentrations of TCE ($>1,000 \mu\text{g/kg}$), the analytical results from the offsite laboratory are consistently higher than those from the onsite mobile laboratory (e.g., HCS-BG-5 and HCS-BG-5ON). The discrepancy may be explained because of inherent differences in the calibration of the two instruments.

The onsite mobile laboratory was calibrated for detecting lower levels of VOCs than was the instrument at the offsite laboratory. For this reason, in order to remain within the calibration range of the onsite mobile laboratory when analyzing soil samples containing high concentrations of TCE, the onsite laboratory analyzed very small aliquots of soil sample, effectively diluting the extraction. The smaller sample had a higher ratio of surface area to mass, possibly increasing volatilization. In addition, small samples are often less representative than larger samples. The significant increase in concentration for soils containing high levels of TCE may be explained because the offsite laboratory used larger soil aliquots for their analysis.

Table 3-5 presents a statistical analysis of analytical data for VOCs detected by the offsite laboratory. Duplicate samples were not included in the statistical analysis.

TCE was detected in all of the 21 soil samples analyzed by the offsite laboratory. TCE concentrations ranged from $1 \mu\text{g/kg}$ to $160,000 \mu\text{g/kg}$. 1,1,1-TCA was detected in 3 of the 21 samples. Two of the samples containing 1,1,1-TCA were collected from one of the solvent disposal pits and the other, containing only $5 \mu\text{g/kg}$ of 1,1,1-TCA, was collected downgradient of the solvent disposal pits.

Total DCE was detected in 4 of the 21 samples with two of the samples containing less than $33 \mu\text{g/kg}$. The other two samples were located along the river and both contained high concentrations of TCE. Total xylenes were detected in 9 of the 21 samples with only 2 of the samples exceeding $6 \mu\text{g/kg}$. Both of these samples were collected from the solvent disposal pits. Tetrachloroethene (PCE) was detected in 4 of the 21 samples. Only 2 of the samples contained more than $12 \mu\text{g/kg}$ PCE and both samples were collected from the solvent disposal pits.

Review of the analytical data for VOC-contaminated soil clearly indicates that TCE is the VOC contaminant most prevalent and at the highest concentrations in soils at Site 1. In addition, other VOCs detected generally are found in sampling locations containing high concentrations of TCE (e.g., solvent disposal pits). Hence, the approximate extent of TCE soil contamination is a good indicator for the approximate extent of VOC-contaminated soil at Site 1.

Figure 3-2 shows the location and TCE concentrations for all soil samples collected at Site 1. For soil samples analyzed by both laboratories, the higher concentration reported is included in the figure. This also is true for duplicate samples.

TABLE 3-5

SITE 1

STATISTICAL ANALYSIS OF VOCs DETECTED IN SOIL SAMPLES ANALYZED AT OFFSITE LABORATORY

| | Maximum Concentration | Minimum Concentration | Standard Deviation | Arithmetic Mean | Frequency | Detected Count | Total Count |
|----------------------------------|--------------------------|--------------------------|-----------------------|--------------------|-----------|-------------------|----------------|
| VOLATILE ORGANICS (UG/KG) | | | | | | | |
| 1,1,1-TRICHLOROETHANE | 410 | 5 | 102.1 | 36.4 | 0.14 | 3 | 21 |
| 1,2-DICHLOROETHENE (TOTAL) | 27000 | 5 | 5887.7 | 1305.0 | 0.19 | 4 | 21 |
| 2-BUTANONE | 1400 | 5 | 304.4 | 71.4 | 0.05 | 1 | 21 |
| ACETONE | 820 | 5 | 196.4 | 64.0 | 0.10 | 2 | 21 |
| CARBON DISULFIDE | 6 | 2 | 1.0 | 4.7 | 0.19 | 4 | 21 |
| TETRACHLOROETHENE | 1400 | 3 | 309.0 | 87.1 | 0.19 | 4 | 21 |
| TOLUENE | 170 | 5 | 36.0 | 12.9 | 0.05 | 1 | 21 |
| TRICHLOROETHENE | 160000 | 1 | 41733.9 | 19256.5 | 1.00 | 21 | 21 |
| XYLENES (TOTAL) | 290 | 2 | 72.7 | 26.7 | 0.43 | 9 | 21 |

Note: A value equal to one-half the detection limit was entered for all non-detects.



The highest concentrations of TCE were detected in the solvent disposal pits, near the inert burn area, and along the river immediately north of the ordnance burning ground. Samples collected from all depths in solvent disposal pits 1 and 3 contained high concentrations of TCE. TCE concentrations increased with depth in Pit 1 and decreased with depth in Pit 3.

The four samples collected along the river contained high TCE concentrations. These samples were analyzed by the offsite laboratory with the exception of the sample reported by the onsite mobile laboratory to contain 16,000 $\mu\text{g/kg}$. Because a comparison of samples reported by the onsite mobile laboratory and the offsite laboratory as having high concentrations of TCE shows that the offsite laboratory results are consistently higher, the concentration of TCE in this sample is possibly higher than 16,000 $\mu\text{g/kg}$. All four of the samples were collected from 2-3 foot depths. No samples were collected from greater depths at these locations because saturated soils were encountered at 3-4 feet.

Some areas of Site 1 contain low concentrations of TCE. Little or no TCE contamination was detected in soil samples collected at any depth from the drum storage pad area. This is consistent with results of the soil sampling conducted during the IAS. Samples collected at any depth immediately south of all three disposal pits contained little or no TCE above detection limits. Little or no TCE was detected southwest or southeast of the ordnance burning ground and low levels were detected in the southeast portion of the ordnance burning ground. This is consistent with soil-gas sampling reported in the Interim RI.

SVOCs Detected in Soils

As discussed in Section 4 of the Draft RI Report, soil samples were collected from each of the eight burn pads, one from the historical bottom of solvent disposal pit 3, and three from soil below the ash layer in the open burn area were analyzed for SVOCs (see Figure 4-3 in the Draft RI Report). All soil samples were analyzed for TCL SVOCs. Results of the SVOC analysis for these samples are presented in Appendix A of the Draft RI Report. Table 3-6 shows only the SVOCs detected in each of the samples. Sample HCS-BG-4 was collected from solvent disposal pit 3. Four different SVOCs were detected in sample HCS-BG-4 at levels estimated below the detection limit.

In general, samples collected from the eight burn pads contained low levels of SVOCs. Samples HCS-BP-3, HCS-BP-4, and HCS-BP-8 contained no SVOCs above the detection limit. With the exception of bis(2-ethylhexyl)phthalate, di-n-butylphthalate, and 2-nitroaniline, SVOCs detected in soil samples collected from the burn pads were estimated concentrations below the detection limit. Sample HCS-BP-1 was the only burn pad sample from the containing bis(2-ethylhexyl)phthalate and di-n-butylphthalate, with the latter compound detected in the blank sample. Sample HCS-BP-7 was the only sample that contained 2-nitroaniline.

Table 3-6
SITE 1 SEMIVOLATILE ORGANICS DETECTED IN SOIL SAMPLES
 (Units in µg/kg)

Page 1 of 2

| | HCS-B2-4 | HCS-B2-5 | HCS-B2-6 | HCS-BG-4 | HCS-BP-1 | HCS-BP-1DL |
|----------------------------|----------|----------|----------|----------|----------|------------|
| 2,4-Dinitrotoluene | | | | | 720 JQ | |
| 2,6-Dinitrotoluene | | | | | 130 J | |
| 2-Methylnaphthalene | 120 J | 40 J | 68 J | 350 JC | | |
| Acenaphthene | | 67 J | | | | |
| Acenaphthylene | | | | | | |
| Anthracene | 730 | 190 J | | | | |
| Benzo(a)anthracene | 1,700 | 700 | 95 J | | | |
| Benzo(a)pyrene | 1,400 | 690 | 83 J | | | |
| Benzo(b)fluoranthene | 1,500 | 730 | 100 J | | | |
| Benzo(g,h,i)perylene | 910 | 440 | 84 J | | | |
| Benzo(k)fluoranthene | 1,100 | 580 | 130 J | | | |
| Bis(2-ethylhexyl)phthalate | | | 82 BJ | 320 J | 1,600 | 1,600 D |
| Chrysene | 1,600 | 870 | 160 J | | | |
| Di-N-Butylphthalate | | | | 150 BJ | 5,100 JB | 4,900 BD |
| Dibenz(a,h)anthracene | 230 J | | | | | |
| Dibenzofuran | 260 J | 52 J | | | | |
| Fluoranthene | 2,900 | 1,200 | 200 J | | | |
| Fluorene | 410 | 81 J | | | | |
| Indeno(1,2,3-CD)pyrene | 790 | 390 J | 60 J | | | |

Table 3-6
SITE 1 SEMIVOLATILE ORGANICS DETECTED IN SOIL SAMPLES
 (Units in µg/kg)

Page 2 of 2

| | HCS-B2-4 | HCS-B2-5 | HCS-B2-6 | HCS-BG-4 | HCS-BP-1 | HCS-BP-1DL |
|----------------------------|----------|----------|----------|-----------|----------|------------|
| N-Nitrosodiphenylamine (1) | | | | | 64 J | 160 DJ |
| Naphthalene | 76 J | | | 250 J | | |
| Phenanthrene | 2,300 | 720 | 180 J | | | |
| Pyrene | 2,300 | 970 | 170 J | | | |
| | | | | | | |
| | HCS-BP-2 | HCS-BP-3 | HCS-BP-4 | HCSD-BP-4 | HSC-BP-5 | HCS-BP-6 |
| 2-Nitroaniline | | | | | 94 J | |
| Bis(2-ethylhexyl)phthalate | | | | 59 J | 290 J | 41 J |
| Diethylphthalate | | | | | 92 J | |
| Fluoranthene | 42 J | | | | | |
| | | | | | | |
| | HCS-BP-7 | | | | | |
| 2-Nitroaniline | 13,000 J | | | | | |
| Bis(2-ethylhexyl)phthalate | 1,400 J | | | | | |
| N-Nitrosodiphenylamine (1) | 3,000 J | | | | | |

Samples HCS-B2-4 through HCS-B2-6 were collected from the open burn area. These samples contained a much wider range of SVOCs at higher concentrations than was found in the samples from the burn pads. These samples contained a number of polycyclic aromatic hydrocarbons (PAHs) with benzo(a)pyrene, the most carcinogenic, ranging from 83 to 1,400 $\mu\text{g/kg}$.

Explosives Detected in Soils

As discussed in Section 4 of the Draft RI Report, one soil sample was collected from each of the eight burn pads and analyzed for explosives. Table 3-7 lists the explosive compounds analyzed for, and the results. Except for sample HCS-BP-7, HMX and RDX were the only explosive compounds detected. Sample HCS-BP-7 contained 1,3,5-trinitrobenzene, nitrobenzene, and tetryl. HMX was detected in six of the eight samples with concentrations ranging from 2.3 $\mu\text{g/kg}$ to 14 $\mu\text{g/kg}$. RDX was detected in all eight samples with concentrations ranging from 2.1 $\mu\text{g/kg}$ to 34 $\mu\text{g/kg}$. Sample HCS-BP-6 contained the highest concentrations detected of both compounds.

Metals Detected in Soils and Ash

As discussed in Section 4 of the Draft RI Report, soil and ash samples were collected from the inert burn area and the open burn area and screened for metals using XRF and analyzed for metals by the offsite laboratory. The XRF was used as a field-screening tool to determine sample locations with possible high concentrations of metals. The samples then were analyzed at the offsite laboratory. The offsite laboratory analyzed for all metals included on the EPA TAL. Table 3-8 presents the analytical data for metals for soil and ash samples collected at Site 1 and analyzed by the offsite laboratory. All samples with the prefix HCS-B1 were collected from the inert burn area and all samples with the prefix HCS-B2 were collected from the open burn area (see Figure 4-3 in the Draft RI Report). All sample numbers ending with the letter "S" are ash samples and all sample numbers ending with a number represent the depth in feet which soil samples were collected. Samples HCS-B1-C and HCS-B2-C are composites of ash samples collected from each area.

Table 3-9 presents a statistical analysis of the metals data for the soil and ash samples collected at Site 1 and does not include duplicate samples. Lead was detected in all samples, with concentrations ranging from 607 mg/kg to 12,010 mg/kg in the ash from the inert burn area and from 200 mg/kg to 1,630 mg/kg in the ash from the open burn area. Lead concentrations ranged from 6.5 mg/kg to 993 mg/kg in the soil from the inert burn area and from 68.6 mg/kg to 472 mg/kg in the soil from the open burn area. Mercury, beryllium, and arsenic were detected at low levels in all samples.

SITE 1 - EXPLOSIVES ANALYTICAL DATA FOR SOIL
(UNITS IN MG/KG)

| | HCS-BP-1 | | HCS-BP-2 | | HCS-BP-3 | | HCS-BP-4 | | HCSD-BP-4 | | HCS-BP-5 | |
|-----------------------|----------|-----|----------|-----|----------|-----|----------|-----|-----------|-----|----------|-----|
| 1,3,5-TRINITROBENZENE | 0.25 | U | 0.25 | U | 0.25 | U | 0.25 | U | 0.25 | U | 0.25 | U |
| 1,3-DINITROBENZENE | 0.25 | U | 0.25 | U | 0.25 | U | 0.25 | U | 0.25 | U | 0.25 | U |
| 2,4,6-TRINITROTOLUENE | 0.25 | U | 0.25 | U | 0.25 | U | 0.25 | U | 0.25 | U | 0.25 | U |
| 2,4-DINITROTOLUENE | 1 | U | 0.51 | U | 0.51 | U | 0.51 | U | 0.51 | U | 0.51 | U |
| 2,6-DINITROTOLUENE | 1 | U | 0.51 | U | 0.51 | U | 0.51 | U | 0.51 | U | 0.51 | U |
| 2-NITROTOLUENE | 0.25 | U | 0.25 | U | 0.25 | U | 0.25 | U | 0.25 | U | 0.25 | U |
| 3-NITROTOLUENE | 0.25 | U | 0.25 | U | 0.25 | U | 0.25 | U | 0.25 | U | 0.25 | U |
| HMX | 7.6 | | 4.6 | | 2.2 | U | 2.3 | | 2.2 | U | 3.9 | |
| NITROBENZENE | 0.26 | UJC | 0.26 | UJC | 0.26 | UJC | 0.26 | UJC | 0.26 | UJC | 0.26 | UJC |
| RDX | 6.6 | | 7.3 | | 2.6 | | 2.1 | | 2.1 | | 5.1 | |
| TETRYL | 0.65 | UJC | 0.65 | UJC | 0.65 | UJC | 0.65 | UJC | 0.65 | UJC | 0.65 | UJC |
| | | | | | | | | | | | | |
| | HCS-BP-6 | | HCS-BP-7 | | HCS-BP-8 | | | | | | | |
| 1,3,5-TRINITROBENZENE | 0.25 | U | 30 | | 0.25 | U | | | | | | |
| 1,3-DINITROBENZENE | 0.25 | U | 0.25 | U | 0.25 | U | | | | | | |
| 2,4,6-TRINITROTOLUENE | 0.25 | U | 0.25 | U | 0.25 | U | | | | | | |
| 2,4-DINITROTOLUENE | 0.51 | U | 0.51 | U | 0.51 | U | | | | | | |
| 2,6-DINITROTOLUENE | 0.51 | U | 0.51 | U | 0.51 | U | | | | | | |
| 2-NITROTOLUENE | 0.25 | U | 0.25 | U | 0.25 | U | | | | | | |
| 3-NITROTOLUENE | 0.25 | U | 0.25 | U | 0.25 | U | | | | | | |
| HMX | 14 | | 12 | | 2.2 | U | | | | | | |
| NITROBENZENE | 0.26 | UJC | 0.55 | JC | 0.26 | UJC | | | | | | |
| RDX | 34 | | 2.8 | | 2.8 | | | | | | | |
| TETRYL | 0.65 | UJC | 0.54 | JC | 0.65 | UJC | | | | | | |

TABLE 3-8
SITE 1 - METALS ANALYTICAL DATA FOR SOIL AND ASH (MG/KG)

| | HCS-B1-31 (MG/KG) | | HCS-B1-3S (MG/KG) | | HCS-B1-4S (MG/KG) | | HCS-B1-112 (MG/KG) | | HCS-B1-11S (MG/KG) | | HCSD-B1-31 (MG/KG) | |
|-----------|----------------------|-----|----------------------|-----|----------------------|----|-----------------------|----|-----------------------|-----|-----------------------|-----|
| ALUMINUM | 8120 | JD | 17500 | JD | 96900 | JD | 19900 | JD | 51700 | JD | 18800 | JD |
| ANTIMONY | 2.8 | JS | 4.3 | JS | 12.9 | JS | 12.9 | JS | 16.4 | JS | 2.9 | JS |
| ARSENIC | 4.5 | | 14.4 | JS | 8.4 | JS | 12.8 | JS | 14.2 | JS | 4.5 | JS |
| BARIUM | 109 | | 338 | | 758 | | 1510 | | 425 | | 138 | |
| BERYLLIUM | 0.9 | | 0.91 | | 0.53 | | 0.86 | | 0.81 | | 0.87 | |
| CADMIUM | 0.67 | JS | 21.6 | JS | 57.1 | JS | 46.8 | JS | 154 | JS | 3.4 | JS |
| CALCIUM | 2480 | | 5800 | | 8790 | | 20400 | | 3600 | | 2980 | |
| CHROMIUM | 13.2 | JS | 46.1 | JS | 100 | JS | 99.8 | JS | 103 | JS | 46.9 | JS |
| COBALT | 14.3 | | 18.3 | | 39.8 | | 26.8 | | 31.6 | | 14.5 | |
| COPPER | 28.8 | JS | 226 | JS | 780 | JS | 1390 | JS | 855 | JS | 79.9 | JS |
| IRON | 27500 | | 26200 | | 122000 | | 81100 | | 45700 | | 28400 | |
| LEAD | 6.5 | JS | 607 | | 12100 | | 993 | | 6680 | | 173 | |
| MAGNESIUM | 1600 | | 1870 | | 8810 | | 9160 | | 4230 | | 1630 | |
| MANGANESE | 686 | | 588 | | 592 | | 1920 | | 681 | | 597 | |
| MERCURY | 0.23 | | 0.31 | | 1 | | 4.6 | | 2.5 | | 0.28 | |
| NICKEL | 19.4 | | 44.2 | | 107 | | 102 | | 74.1 | | 25.7 | |
| POTASSIUM | 911 | | 1460 | | 1520 | | 1750 | | 1110 | | 882 | |
| SELENIUM | 0.42 | UJS | 0.71 | JS | 3.9 | JS | 0.71 | JS | 0.47 | RS | 0.55 | JS |
| SILVER | 0.42 | | 4.2 | | 12.6 | | 104 | | 24.8 | | 1.1 | |
| SODIUM | 210 | UJB | 467 | UJB | 9740 | | 1290 | JB | 373 | UJB | 251 | UJB |
| THALLIUM | 0.47 | U | 0.64 | U | 0.56 | U | 0.56 | U | 0.52 | U | 0.49 | |
| VANADIUM | 17.6 | | 34.7 | | 18.1 | | 97.5 | | 30.3 | | 17.9 | |
| ZINC | 95 | JS | 1010 | JS | 3860 | JS | 3350 | JS | 2160 | JS | 383 | JS |

TABLE
SITE 1 - METALS ANALYTICAL DATA FOR SOIL AND ASH (MG/KG)

| | HCS-D-B1-3S (MG/KG) | | HCS-B1-C (MG/KG) | | HCS-B2-3S (MG/KG) | | HCS-B2-10 (MG/KG) | | HCS-B2-34 (MG/KG) | | HCS-B2-73 (MG/KG) | | HCS-B2-7S (MG/KG) | |
|-----------|------------------------|-----|---------------------|-----|----------------------|-----|----------------------|----|----------------------|-----|----------------------|-----|----------------------|-----|
| ALUMINUM | 37100 | JD | 7510 | JD | 11200 | JD | 34700 | JD | 6110 | JD | 5000 | JD | 8430 | JD |
| ANTIMONY | 12.3 | JS | 3.1 | JS | 3.1 | JS | 25.1 | JS | 3.4 | JS | 3.2 | JS | 4.5 | JS |
| ARSENIC | 13.9 | | 7.3 | JS | 9.5 | JS | 11 | JS | 7.7 | JS | 6.9 | JS | 14.3 | JS |
| BARIUM | 389 | | 94.8 | | 512 | | 695 | | 132 | | 72.3 | | 195 | |
| BERYLLIUM | 0.83 | | 0.18 | | 1.4 | | 0.93 | | 1.4 | | 1.2 | | 1.1 | |
| CADMIUM | 22.9 | JS | 3.3 | JS | 5.3 | JS | 37.5 | JS | 0.74 | UJS | 0.71 | UJS | 1.9 | JS |
| CALCIUM | 4900 | | 1070 | | 12800 | | 20500 | | 4460 | | 2180 | | 6520 | |
| CHROMIUM | 51.4 | JS | 10 | JS | 55.1 | JS | 110 | JS | 31.5 | JS | 15.3 | JS | 29.8 | JS |
| COBALT | 28.4 | | 5.5 | | 24.6 | | 30.6 | JS | 21.1 | | 18.9 | | 25.6 | |
| COPPER | 309 | JS | 81.9 | JS | 579 | JS | 1970 | JS | 136 | JS | 54.5 | JS | 2150 | JS |
| IRON | 27200 | | 10500 | | 31900 | | 31300 | | 28500 | | 30400 | | 25100 | |
| LEAD | 793 | JS | 4990 | | 1630 | | 472 | | 68.6 | | 74.6 | | 272 | |
| MAGNESIUM | 2010 | | 737 | | 1840 | | 9840 | | 2190 | | 662 | | 2110 | |
| MANGANESE | 1030 | | 147 | | 663 | | 926 | | 501 | | 559 | | 552 | |
| MERCURY | 0.56 | | 2.1 | | 1.2 | | 16.8 | | 0.32 | | 0.4 | | 2.7 | |
| NICKEL | 39.4 | | 11.4 | | 49.7 | | 185 | | 55.1 | | 38 | | 40.3 | |
| POTASSIUM | 1510 | | 151 | U | 765 | | 1710 | | 620 | | 558 | | 885 | |
| SELENIUM | 0.5 | JS | 0.47 | RS | 0.56 | JS | 0.61 | JS | 0.94 | JS | 0.78 | JS | 0.79 | JS |
| SILVER | 5.8 | | 8.9 | | 78.8 | | 106 | | 6.5 | | 2.1 | | 121 | |
| SODIUM | 335 | UJB | 342 | UJB | 419 | UJB | 1290 | | 298 | UJB | 315 | UJB | 244 | UJB |
| THALLIUM | 0.55 | U | 0.51 | U | 0.52 | U | 0.52 | U | 0.56 | U | 0.54 | U | 0.46 | U |
| VANADIUM | 22.3 | | 5.6 | | 33.4 | | 100 | | 108 | | 14.6 | | 82.7 | |
| ZINC | 1290 | JS | 291 | JS | 679 | JS | 4230 | JS | 408 | JS | 163 | JS | 636 | JS |

TABLE 3-8
SITE 1 - METALS ANALYTICAL DATA FOR SOIL AND ASH (MG/KG)

| | HCS-B2-C (MG/KG) | |
|-----------|---------------------|-----|
| ALUMINUM | 11100 | JD |
| ANTIMONY | 5 | JS |
| ARSENIC | 12.9 | JS |
| BARIUM | 248 | |
| BERYLLIUM | 1.5 | |
| CADMIUM | 6.8 | JS |
| CALCIUM | 11500 | |
| CHROMIUM | 34 | JS |
| COBALT | 25.5 | |
| COPPER | 348 | JS |
| IRON | 31900 | |
| LEAD | 200 | |
| MAGNESIUM | 1940 | |
| MANGANESE | 770 | |
| MERCURY | 3.2 | |
| NICKEL | 66.4 | |
| POTASSIUM | 781 | |
| SELENIUM | 0.54 | JS |
| SILVER | 64.5 | |
| SODIUM | 439 | UJB |
| THALLIUM | 0.49 | U |
| VANADIUM | 75.8 | |
| ZINC | 849 | JS |

TABLE 3-9
SITE 1 - STATISTICAL ANALYSIS OF METALS DETECTED IN SOILS AND ASH

| INORGANICS (MG/KG) | Maximum Concentration | Minimum Concentration | Standard Deviation | Arithmetic Mean | Frequency | Detected Count | Total Count |
|--------------------|--------------------------|--------------------------|-----------------------|--------------------|-----------|-------------------|----------------|
| ALUMINUM | 96900 | 5000 | 27010.1 | 23180.8 | 1.00 | 12 | 12 |
| ANTIMONY | 25.1 | 2.8 | 7.2 | 8.1 | 1.00 | 12 | 12 |
| ARSENIC | 14.4 | 4.5 | 3.4 | 10.3 | 1.00 | 12 | 12 |
| BARIUM | 1510 | 72.3 | 413.4 | 424.1 | 1.00 | 12 | 12 |
| BERYLLIUM | 1.5 | 0.18 | 0.4 | 1.0 | 1.00 | 12 | 12 |
| CADMIUM | 154 | 0.5 | 44.4 | 28.0 | 0.83 | 10 | 12 |
| CALCIUM | 20500 | 1070 | 6713.7 | 8341.7 | 1.00 | 12 | 12 |
| CHROMIUM | 110 | 10 | 38.6 | 54.0 | 1.00 | 12 | 12 |
| COBALT | 39.8 | 5.5 | 8.9 | 23.6 | 1.00 | 12 | 12 |
| COPPER | 2150 | 28.8 | 747.7 | 716.6 | 1.00 | 12 | 12 |
| IRON | 122000 | 10500 | 30605.7 | 41008.3 | 1.00 | 12 | 12 |
| LEAD | 12100 | 6.5 | 3748.0 | 2341.1 | 1.00 | 12 | 12 |
| MAGNESIUM | 9840 | 662 | 3451.1 | 3749.1 | 1.00 | 12 | 12 |
| MANGANESE | 1920 | 147 | 421.6 | 715.4 | 1.00 | 12 | 12 |
| MERCURY | 16.8 | 0.23 | 4.6 | 2.9 | 1.00 | 12 | 12 |
| NICKEL | 185 | 11.4 | 47.3 | 66.1 | 1.00 | 12 | 12 |
| POTASSIUM | 1750 | 500 | 452.0 | 1047.5 | 0.92 | 11 | 12 |
| SELENIUM | 3.9 | 0.5 | 1.0 | 1.0 | 0.90 | 9 | 10 |
| SILVER | 121 | 0.42 | 46.9 | 44.5 | 1.00 | 12 | 12 |
| SODIUM | 9740 | 500 | 2643.5 | 1401.7 | 0.25 | 3 | 12 |
| VANADIUM | 108 | 5.6 | 38.2 | 51.5 | 1.00 | 12 | 12 |
| ZINC | 4230 | 95 | 1518.8 | 1477.6 | 1.00 | 12 | 12 |

Note: A value equal to one-half the detection limit was entered for all non-detects.

Dioxin Detected in Ash Samples

Samples HCS-B1-C and HCS-B2-C represent composites of ash samples collected from the inert burn area and the open burn area, respectively. The samples were analyzed for dioxins using method SW8280. Table 3-10 presents dioxin analytical data for the composite ash samples. The table shows that 2,3,7,8-TCDD the most toxic dioxin congener, was not detected in either sample. Sample HCS-B1-C on average appears to contain twice the level of total dioxins and furans than HCS-B2-C. However, only trace levels of these compounds were detected in both samples.

TCLP Analysis of Composite Ash Samples

TCLP analysis was performed on composite ash samples HCS-B1-C and HCS-B2-C. Table 3-11 presents the results of the TCLP analysis. Comparing these results to maximum concentrations of metals allowed under TCLP restrictions, the only metal exceeding these concentrations is lead in sample HCS-B1-C. Cadmium was also detected at elevated levels.

Groundwater Contamination

Groundwater monitoring wells were installed and sampled at Plant 1 during the Confirmation Study and the RI. Wells in the vicinity of Site 1 were analyzed for TCL SVOCs, and VOCs, TAL, inorganics, xylenes, MEK, MIBK, TCDD, explosives, TNT breakdown products, and nitrates during the Confirmation Study. After review of the groundwater analytical results presented in the Interim RI Report, the RI installed additional wells at Plant 1 and analyzed groundwater samples collected from all wells installed during the Confirmation Study and RI for TCL VOCs, TAL inorganics and explosives. Results of both investigations have indicted VOCs to be the primary contaminants in groundwater at Site 1 with inorganics and explosives detected at low levels. For this reason, only results of these analyses are discussed. In addition, groundwater contamination is discussed generally for Plant 1 with specific reference to Site 1 as appropriate. This is done to give a more comprehensive understanding of groundwater contamination not only at Site 1, but upgradient and surrounding Site 1.

TABLE 3-10
SITE 1 - DIOXIN ANALYTICAL DATA
FOR COMPOSITE ASH SAMPLES
(UNITS IN UG/KG)

| | HCS-B1-C | HCS-B2-C |
|-------------------------------------|------------|----------|
| 1,2,3,4,6,7,8-HEPTACHLORODIBENZO-p- | 0.34 JC | 0.51 |
| 1,2,3,4,6,7,8-HEPTACHLORODIBENZOFUR | 1.1 JC | 0.36 |
| 1,2,3,4,7,8,9-HEPTACHLORODIBENZOFUR | 0.079 JC | 0.032 U |
| 1,2,3,4,7,8-HEXACHLORODIBENZO-p-DIO | 0.099 UJC | 0.13 U |
| 1,2,3,4,7,8-HEXACHLORODIBENZOFURAN | 0.41 UJC | 0.29 U |
| 1,2,3,6,7,8-HEXACHLORODIBENZO-p-DIO | 0.12 UJC | 0.12 U |
| 1,2,3,6,7,8-HEXACHLORODIBENZOFURAN | 0.36 UJC | 0.24 U |
| 1,2,3,7,8,9-HEXACHLORODIBENZO-p-DIO | 0.018 UJC | 0.068 U |
| 1,2,3,7,8,9-HEXACHLORODIBENZOFURAN | 0.04 UJC | 0.14 U |
| 1,2,3,7,8-PENTACHLORODIBENZO-p-DIOX | 0.056 JC | 0.11 U |
| 1,2,3,7,8-PENTACHLORODIBENZOFURAN | 0.22 JC | 0.076 |
| 2,3,4,6,7,8-HEXACHLORODIBENZOFURAN | 0.031 UJC | 0.14 U |
| 2,3,4,7,8-PENTACHLORODIBENZOFURAN | 0.24 JC | 0.058 U |
| 2,3,7,8-TETRACHLORODIBENZO-p-DIOXIN | 0.0065 UJC | 0.1 U |
| 2,3,7,8-TETRACHLORODIBENZOFURAN | 0.14 JC | 0.12 U |
| TOTAL-HEPTACHLORODIBENZO-p-DIOXIN | 0.85 JC | 1.3 |
| TOTAL-HEPTACHLORODIBENZOFURAN | 1.5 JC | 0.44 |
| TOTAL-HEXACHLORODIBENZO-p-DIOXIN | 1.1 JC | 1.8 |
| TOTAL-HEXACHLORODIBENZOFURAN | 1.7 JC | 0.78 |
| TOTAL-OCTACHLORODIBENZO-p-DIOXIN | 0.15 JC | 3.3 |
| TOTAL-OCTACHLORODIBENZOFURAN | 1.7 JC | 0.43 U |
| TOTAL-PENTACHLORODIBENZO-p-DIOXIN | 0.83 JC | 0.41 |
| TOTAL-PENTACHLORODIBENZOFURAN | 1.2 JC | 0.15 |
| TOTAL-TETRACHLORODIBENZO-p-DIOXIN | 0.66 JC | 0.32 |
| TOTAL-TETRACHLORODIBENZOFURAN | 3.3 JC | 0.36 |

Table 3-11
RESULTS OF TCLP ANALYSIS OF COMPOSITE ASH SAMPLES

| Metals | HCS-B1-C ($\mu\text{g/l}$) | HCS-B2-C ($\mu\text{g/l}$) | TCLP maximum concentrations ($\mu\text{g/l}$) |
|--|--|--|---|
| Arsenic | 25.3 U | 27.3 B | 5,000 |
| Barium | 2,430 | 971 | 100,000 |
| Cadmium | 216 | 63.3 | 1,000 |
| Chromium | 8.9 B | 4 B | 5,000 |
| Lead | 6,010 | 128 | 5,000 |
| Mercury | 0.2 B | 0.2 B | 200 |
| Selenium | 31.3 U | 31.3 U | 1,000 |
| Silver | 2 B | 1.6 B | 5,000 |
| U = Not detected above detection limit. B = Detected in blank sample. | | | |

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VOCs Detected in Groundwater

The VOC analytical data generated during the RI for Plant 1 wells are presented in Tables 7-20 and 7-21 and Appendix A of the Draft RI Report. The data indicate that fourteen VOCs¹ were detected in the groundwater beneath Plant 1:

- 1,1,1-TCA
- 1,1-DCA
- 1,1-DCE
- 1,2-Dichloroethane (1,2-DCA)
- 1,2-DCE (Total)
- 2-Butanone, or MEK
- Acetone
- Carbon Disulfide
- Carbon Tetrachloride
- Chloroform
- Methylene Chloride
- PCE
- Toluene
- TCE

The six most prevalent VOCs (detected in six or more samples), in order of frequency of detection were: TCE, methylene chloride, 1,2-DCE, acetone, PCE, and 1,1,1-TCA. The locations and concentrations of these six VOCs in the alluvial and bedrock aquifers beneath Plant 1 are shown in Figures 3-3 and 3-4, respectively. Each of the remaining eight detected VOCs were found in three or fewer samples.

TCE was the most frequently detected VOC at Plant 1. It was detected in 25 of the 37 wells sampled, at concentrations ranging from 1 to 98,000 $\mu\text{g/l}$. TCE also was the most widely distributed VOC across Plant 1. All of the alluvium and bedrock monitoring wells adjacent to the North Branch Potomac River at Site 1 contained detectable levels of TCE. Of the VOC concentrations found in the wells along the river at Site 1, the highest concentrations were found downgradient of the solvent disposal pits, in well cluster 1GW3, 1GW9, 1GW13. Here, TCE was found in the alluvium and shallow bedrock at a concentration of 98,000 $\mu\text{g/l}$ (Well 1GW3), in moderately deep bedrock at a concentration of 71,000 $\mu\text{g/l}$ (Well 1GW9), and in deeper bedrock at a concentration of 1,300 $\mu\text{g/l}$ (Well 1GW13). The magnitude of the concentrations in the three wells suggests that TCE may occur as a DNAPL in this area.

¹Two VOCs, carbon tetrachloride and 2-butanone were only detected in groundwater samples from straddle-packer testing, and therefore, are not included in the statistical analysis presented in Table 7-21 of the Draft RI Report.

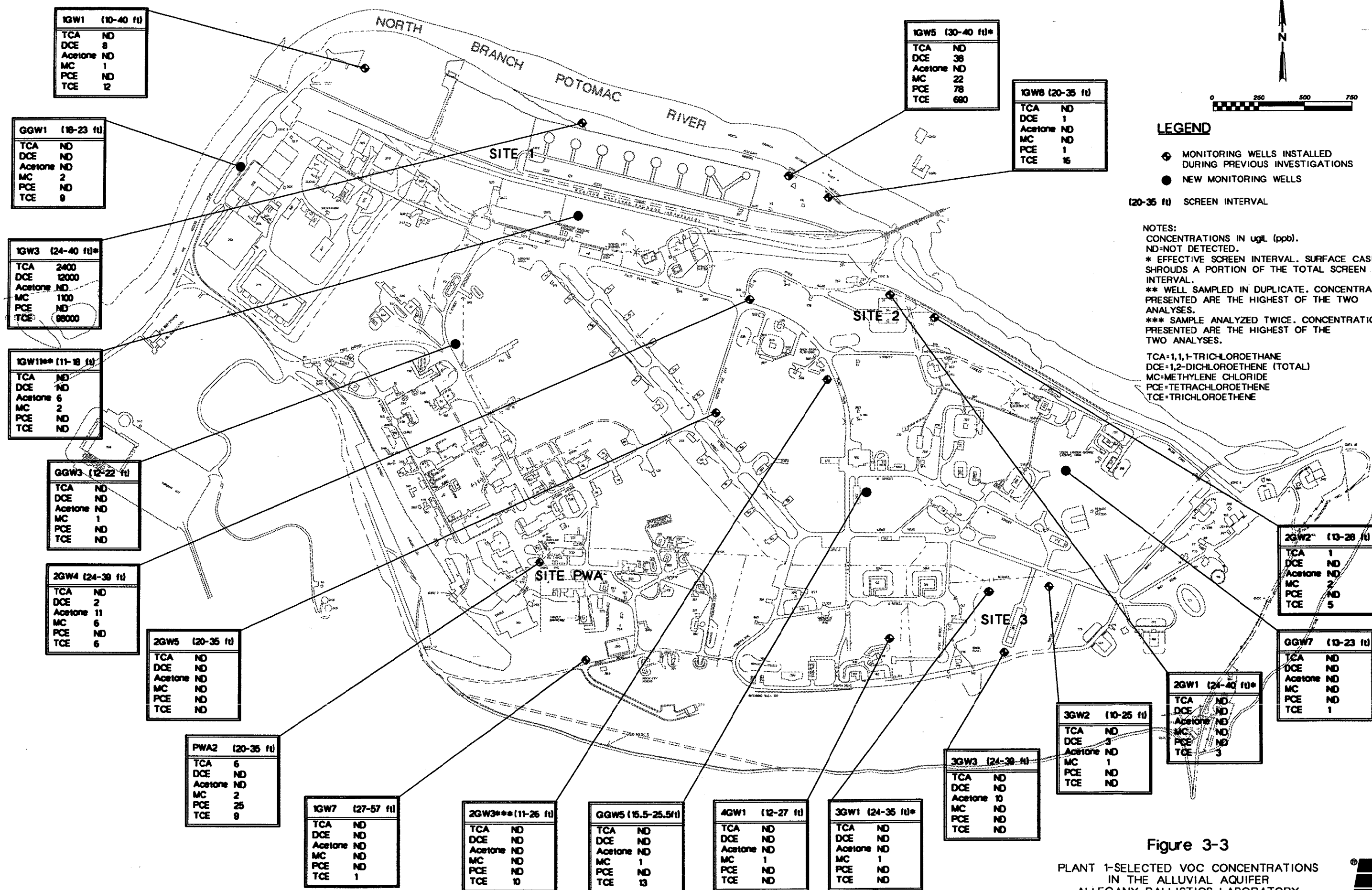


Figure 3-3
 PLANT 1-SELECTED VOC CONCENTRATIONS
 IN THE ALLUVIAL AQUIFER
 ALLEGANY BALLISTICS LABORATORY

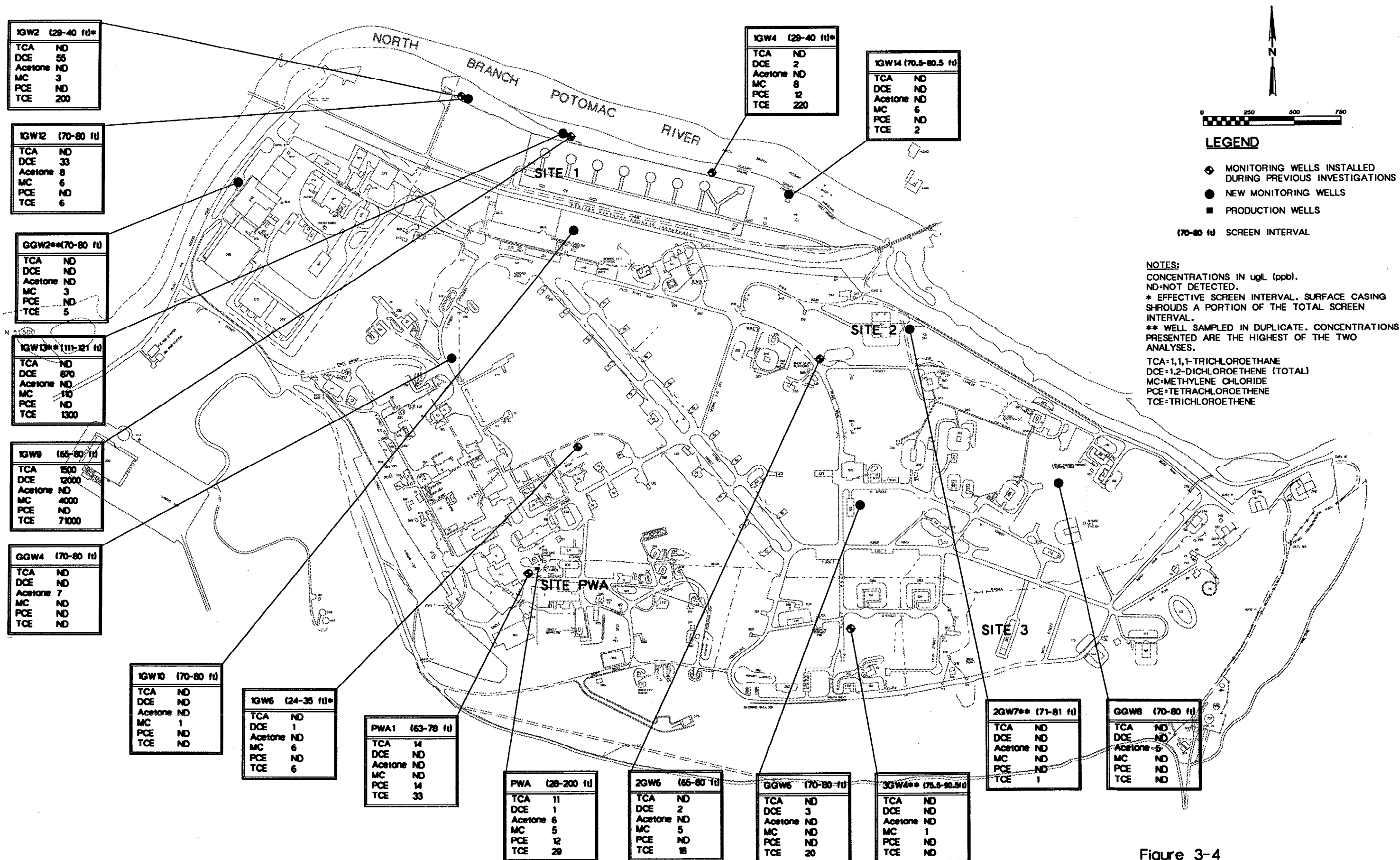


Figure 3-4
PLANT 1-SELECTED VOC CONCENTRATIONS
IN THE BEDROCK AQUIFER
ALLEGANY BALLISTICS LABORATORY

Other relatively high concentrations of TCE found adjacent to the river include 690 $\mu\text{g/l}$ at alluvium well 1GW5, and 220 $\mu\text{g/l}$ at bedrock well 1GW4. TCE also was detected in production well PWA at a concentration of 29 $\mu\text{g/l}$, and in Site PWA bedrock and alluvium monitoring wells PWA1 (33 $\mu\text{g/l}$) and PWA2 (9 $\mu\text{g/l}$).

Other detections of TCE occurred upgradient of Site 2, in alluvium Well 2GW3 at a concentration of 10 $\mu\text{g/l}$, and in bedrock Well 2GW6 at a concentration of 18 $\mu\text{g/l}$. Downgradient of Site 2, TCE was detected in alluvium wells 2GW1 and 2GW2 at concentrations of 3 and 5 $\mu\text{g/l}$, respectively, and in bedrock Well 2GW7 at a concentration of 1 $\mu\text{g/l}$. TCE also was found in the alluvium/bedrock well pair GGW5 and GGW6 at concentrations of 13 and 20 $\mu\text{g/l}$, respectively. Low concentrations of TCE were detected in alluvium wells GGW7 (1 $\mu\text{g/l}$) and 1GW7 (1 $\mu\text{g/l}$), and bedrock well 1GW6 (6 $\mu\text{g/l}$).

Methylene chloride was detected at Plant 1, in 24 of the 37 wells sampled, at concentrations ranging from 1 to 4000 $\mu\text{g/l}$. However, only nine of the samples had concentrations above 5 $\mu\text{g/l}$, the stated quantitation limit. Most of the samples with concentrations above 5 $\mu\text{g/l}$ were obtained from monitoring wells at Site 1 along the river. These wells include the 1GW3, 1GW9, 1GW13 well cluster, downgradient of the solvent disposal pits, where the highest concentrations were found. At this location, methylene chloride concentrations were 1,100 $\mu\text{g/l}$ in the alluvium and shallow bedrock (Well 1GW3), 4,000 $\mu\text{g/l}$ in moderately deep bedrock (Well 1GW9), and 110 $\mu\text{g/l}$ in deeper bedrock (Well 1GW13). Other detections of methylene chloride at concentrations above 5 $\mu\text{g/l}$ along the river included alluvium Well 1GW5 (22 $\mu\text{g/l}$) and bedrock wells 1GW12 (6 $\mu\text{g/l}$) 1GW4 (8 $\mu\text{g/l}$), and 1GW14 (6 $\mu\text{g/l}$).

Other detections of methylene chloride at concentrations above 5 $\mu\text{g/l}$ across Plant 1 included alluvium Well 2GW4 (6 $\mu\text{g/l}$) and bedrock wells PWA (5 $\mu\text{g/l}$), 1GW6 (6 $\mu\text{g/l}$), and 2GW6 (5 $\mu\text{g/l}$).

1,2-DCE was detected at Plant 1 in 15 of the 37 wells sampled with concentrations ranging from 1 $\mu\text{g/l}$ to 12,000 $\mu\text{g/l}$. The only monitoring wells that had 1,2-DCE concentrations above 3 $\mu\text{g/l}$ are located along the river at Site 1. As with TCE and methylene chloride, the highest concentrations of 1,2-DCE were collected from the well cluster 1GW3, 1GW9, 1GW13. 1,2-DCE concentrations were 12,000 $\mu\text{g/l}$ in the alluvium and shallow bedrock (Well 1GW3), 12,000 $\mu\text{g/l}$ in moderately deep bedrock (Well 1GW9), and 870 $\mu\text{g/l}$ in deeper bedrock (Well 1GW13). Other 1,2-DCE concentrations from wells along the river were 8, 38, and 1 $\mu\text{g/l}$ at alluvium wells 1GW1, 1GW5, and 1GW8, respectively, and 55, 33, and 2 $\mu\text{g/l}$ at bedrock wells 1GW2, 1GW12, and 1GW4, respectively.

Acetone was detected at Plant 1 in 7 of 37 wells sampled, at relatively low concentrations ranging from 5 to 11 $\mu\text{g/l}$. Acetone was detected at scattered locations throughout Plant 1 (Figures 3-3 and 3-4).

PCE was detected in 6 of 37 wells sampled at Plant 1 with concentrations ranging from 1 to 78 $\mu\text{g/l}$. All of the PCE detected was found in two general areas: along the river at Site 1, and at Site PWA. At Site 1, PCE was found in alluvium wells 1GW5 and 1GW8 at

concentrations of 78 and 1 $\mu\text{g/l}$, respectively, and in bedrock Well 1GW4 at a concentration of 12 $\mu\text{g/l}$. At Site PWA, production well PWA contained a PCE concentration of 12 $\mu\text{g/l}$ and monitoring wells PWA1 (bedrock) and PWA2 (alluvium) contained concentrations of 14 and 25 $\mu\text{g/l}$, respectively.

1,1,1-TCA was detected in 6 of 37 wells sampled at Plant 1, at concentrations ranging from 1 to 2400 $\mu\text{g/l}$. The only high concentrations of 1,1,1-TCA were found in the two shallowest wells of the well cluster 1GW3, 1GW9, 1GW13, at a concentration of 2,400 $\mu\text{g/l}$ in Well 1GW3 (alluvium and shallow bedrock) and a concentration of 1,500 $\mu\text{g/l}$ in Well 1GW9 (moderately deep bedrock). 1,1,1-TCA was not detected in the deeper bedrock Well 1GW13. Other locations where 1,1,1-TCA was detected included alluvium Well 2GW2 (1 $\mu\text{g/l}$), adjacent to the river near Site 2; production well PWA (11 $\mu\text{g/l}$); and the Site PWA monitoring wells PWA1 (bedrock) and PWA2 (alluvium) at concentrations of 14 and 6 $\mu\text{g/l}$, respectively.

The eight remaining VOCs that were detected in Plant 1 wells were each found in 3 or fewer samples. With the exceptions of 1,1-DCA found at a concentration of 920 $\mu\text{g/l}$ in bedrock Well 1GW9, and chloroform found at a concentration of 12 $\mu\text{g/l}$ in alluvium Well 1GW5, none of the compounds were detected at concentrations exceeding 5 $\mu\text{g/l}$.

Table 3-12 presents a comparison between the analytical data for the groundwater VOCs generated during the RI and the Confirmation Study. Only wells where VOCs were detected in any sampling round are included. When comparing analytical data from different investigations, recognize that sampling techniques, which can have a substantial effect on sample results, may have varied significantly between the RI and the Interim RI report, especially for VOCs.

During the RI, TCE was detected for the first time at very low concentrations in wells 1GW6 (6 $\mu\text{g/l}$), 1GW7 (1 $\mu\text{g/l}$), and 2GW1 (3 $\mu\text{g/l}$). Conversely, TCE was not found in several wells where previous detections had been reported, including wells 3GW1, 3GW3, and 4GW1. The table also shows that a number of VOCs, other than TCE, detected during the Confirmation Study were not detected in the same wells during the RI.

Explosive Compounds Detected In Groundwater

Groundwater samples from 33 wells at Plant 1 were analyzed for explosive compounds. No explosive compounds were detected in any sample.

Inorganics Detected in Groundwater

Tables 7-21 and 7-23 presented in the Draft RI Report give the analytical data for inorganics for all Plant 1 wells.

PLANT 1 -- COMPARISON OF HISTORICAL ANALYTICAL RESULTS
VOCs DETECTED IN GROUNDWATER
(UNITS IN UG/L.)

[illegible]

TABLE 3-12
PLANT 1 — COMPARISON OF HISTORICAL ANALYTICAL RESULTS
VOCs DETECTED IN GROUNDWATER
(UNITS IN UG/L.)

| | 1GW2(87) | | 1GW2(87)DL | | 1GW2(92) | | 1GW3(84) | | 1GW3(86) | | 1GW3(86)DL | | 1GW3(86)DUP | |
|----------------------------|----------|---|------------|---|----------|-----|----------|---|----------|---|------------|---|-------------|---|
| 1,1,1-TRICHLOROETHANE | 5 | U | 25 | U | 8 | UJC | 1300 | | 5400 | | 6000 | J | 1900 | |
| 1,1,2,2-TETRACHLOROETHANE | 5 | U | 25 | U | 8 | UJC | 10 | U | 500 | U | 10000 | U | 10 | U |
| 1,1-DICHLOROETHANE | 5 | U | 25 | U | 8 | U | 550 | | 500 | U | 10000 | U | 42 | |
| 1,1-DICHLOROETHENE | 5 | U | 25 | U | 8 | U | 430 | | 500 | U | 10000 | U | 180 | |
| 1,2-DICHLOROETHANE | 5 | U | 25 | U | 8 | UJC | 10 | U | 500 | U | 10000 | U | 10 | U |
| 1,2-DICHLOROETHENE (TOTAL) | 46 | | 38 | | 55 | | | | 4500 | | 5000 | J | 2200 | |
| 2-BUTANONE | 10 | U | 50 | U | 15 | U | | | 500 | U | 10000 | U | 10 | U |
| ACETONE | 10 | U | 40 | J | 15 | U | | | | | | | | |
| BROMODICHLOROMETHANE | 5 | U | 25 | U | 8 | UJC | 10 | U | 500 | U | 10000 | U | 3 | J |
| CARBON DISULFIDE | 5 | U | 25 | U | 8 | U | | | | | | | | |
| CHLOROBENZENE | 5 | U | 25 | U | 8 | U | 10 | U | 500 | U | 10000 | U | 4 | J |
| CHLOROFORM | 5 | U | 25 | U | 8 | U | 10 | U | 500 | U | 10000 | U | 7 | J |
| METHYLENE CHLORIDE | 2 | J | 12 | J | 3 | J | 7900 | | 500 | U | 10000 | U | 25 | |
| TETRACHLOROETHENE | 5 | U | 25 | U | 8 | U | 10 | U | 500 | U | 10000 | U | 8 | J |
| TOLUENE | 5 | U | 25 | U | 8 | U | 120 | | 500 | U | 10000 | U | 2 | J |
| TRANS-1,3-DICHLOROPROPENE | 5 | U | 25 | U | 8 | U | 10 | U | 95000 | | 10000 | U | 10 | U |
| TRICHLOROETHENE | 300 | | 250 | | 200 | | 6700 | | 500 | U | 130000 | | 2700 | |
| VINYL CHLORIDE | 10 | U | 50 | U | 15 | U | 14 | | 500 | U | 10000 | U | 10 | U |

TABLE 3-12
PLANT 1 - COMPARISON OF HISTORICAL ANALYTICAL RESULTS
VOCs DETECTED IN GROUNDWATER
(UNITS IN UG/L)

| | 1GW3(86)DUPDL | | 1GW3(87) | | 1GW3(87)DL | | 1GW3(87)DUP | | 1GW3(92) | | 1GW4(84) | |
|----------------------------|---------------|---|----------|---|------------|---|-------------|---|----------|-----|----------|----|
| 1,1,1-TRICHLOROETHANE | 4000 | J | 1700 | | 3200 | J | 2900 | J | 2400 | JC | 10 | U |
| 1,1,2,2-TETRACHLOROETHANE | 10000 | U | 5 | U | 5000 | U | 5000 | U | 4500 | UJC | 10 | UJ |
| 1,1-DICHLOROETHANE | 10000 | U | 490 | | 5000 | U | 5000 | U | 4500 | U | 10 | U |
| 1,1-DICHLOROETHENE | 10000 | U | 570 | | 5000 | U | 5000 | U | 4500 | U | 10 | U |
| 1,2-DICHLOROETHANE | 10000 | U | 10 | | 5000 | U | 5000 | U | 4500 | UJC | 10 | U |
| 1,2-DICHLOROETHENE (TOTAL) | 4000 | J | 5300 | | 6000 | | 6000 | | 12000 | | | |
| 2-BUTANONE | 10000 | U | 10 | U | 10000 | U | 10000 | U | 9000 | U | | |
| ACETONE | | | 6 | J | 21000 | | 28000 | | 9000 | U | | |
| BROMODICHLOROMETHANE | 10000 | U | 1 | J | 5000 | U | 5000 | U | 4500 | UJC | 10 | U |
| CARBON DISULFIDE | | | 5 | U | 5000 | U | 5000 | U | 4500 | U | | |
| CHLOROBENZENE | 10000 | U | 5 | U | 5000 | U | 5000 | U | 4500 | U | 10 | U |
| CHLOROFORM | 10000 | U | 9 | | 5000 | U | 5000 | U | 4500 | U | 10 | U |
| METHYLENE CHLORIDE | 10000 | U | 200 | | 3800 | J | 3800 | J | 1100 | J | 10 | U |
| TETRACHLOROETHENE | 10000 | U | 5 | | 5000 | U | 5000 | U | 4500 | U | 10 | UJ |
| TOLUENE | 10000 | U | 63 | | 5000 | U | 5000 | U | 4500 | U | 10 | U |
| TRANS-1,3 DICHLOROPROPENE | 10000 | U | 5 | U | 5000 | U | 5000 | U | 4500 | U | 10 | U |
| TRICHLOROETHENE | 97000 | | 5000 | | 98000 | | 90000 | | 98000 | | 580 | |
| VINYL CHLORIDE | 10000 | U | 16 | | 10000 | U | 10000 | U | 9000 | U | 10 | U |

TABLE 3-12
PLANT 1 - COMPARISON OF HISTORICAL ANALYTICAL RESULTS
VOCs DETECTED IN GROUNDWATER
(UNITS IN UG/L)

| | 1GW4 (86) | | 1GW4 (86) DUP | | 1GW4 (87) | | 1GW4 (92) | | 1GW5 (84) | | 1GW5 (86) | | 1GW5 (86) DUP | |
|----------------------------|-----------|---|---------------|---|-----------|---|-----------|-----|-----------|---|-----------|---|---------------|---|
| 1,1,1-TRICHLOROETHANE | 76 | | 250 | U | 50 | U | 8 | UJC | 10 | U | 5 | J | 100 | U |
| 1,1,2,2-TETRACHLOROETHANE | 10 | U | 250 | U | 50 | U | 8 | UJC | 12 | | 10 | U | 100 | U |
| 1,1-DICHLOROETHANE | 10 | U | 250 | U | 50 | U | 8 | U | 10 | U | 10 | U | 100 | U |
| 1,1-DICHLOROETHENE | 3 | J | 250 | U | 50 | U | 8 | U | 10 | U | 10 | U | 100 | U |
| 1,2-DICHLOROETHANE | 10 | U | 250 | U | 50 | U | 8 | UJC | 10 | U | 10 | U | 100 | U |
| 1,2-DICHLOROETHENE (TOTAL) | 63 | | 250 | U | 50 | U | 2 | J | | | 220 | | 180 | |
| 2-BUTANONE | 10 | U | 250 | U | 100 | U | 15 | U | | | 10 | U | 100 | U |
| ACETONE | | | | | 52 | J | 15 | U | | | | | | |
| BROMODICHLOROMETHANE | 10 | U | 250 | U | 50 | U | 8 | UJC | 10 | U | 10 | U | 100 | U |
| CARBON DISULFIDE | | | | | 50 | U | 8 | U | | | | | | |
| CHLOROBENZENE | 10 | U | 250 | U | 50 | U | 8 | U | 10 | U | 2 | J | 100 | U |
| CHLOROFORM | 10 | U | 250 | U | 50 | U | 8 | U | 10 | U | 11 | | 100 | U |
| METHYLENE CHLORIDE | 6 | J | 250 | U | 37 | J | 8 | | 10 | U | 13 | | 50 | J |
| TETRACHLOROETHENE | 9 | J | 250 | U | 16 | J | 12 | | 14 | | 98 | | 100 | U |
| TOLUENE | 10 | U | 250 | U | 50 | U | 8 | U | 10 | U | 2 | J | 100 | U |
| TRANS-1,3-DICHLOROPROPENE | 10 | U | 250 | U | 50 | U | 8 | U | 10 | U | 10 | U | 100 | U |
| TRICHLOROETHENE | 1400 | | 2800 | | 410 | | 220 | | 270 | | 890 | | 1100 | |
| VINYL CHLORIDE | 10 | U | 250 | U | 100 | U | 15 | U | 10 | U | 38 | | 30 | J |

TABLE 3-12
 PLANT 1 - COMPARISON OF HISTORICAL ANALYTICAL RESULTS
 VOCs DETECTED IN GROUNDWATER
 (UNITS IN UG/L)

| | 1GW5(87) | | 1GW5(87)DL | | 1GW5(92) | | 1GW6(84) | | 1GW6(86) | | 1GW6(87) | | 1GW6(92) | |
|----------------------------|----------|---|------------|---|----------|-----|----------|---|----------|---|----------|---|----------|-----|
| 1,1,1-TRICHLOROETHANE | 5 | U | 50 | U | 20 | UJC | 10 | U | 10 | U | 5 | U | 5 | UJC |
| 1,1,2,2-TETRACHLOROETHANE | 5 | U | 50 | U | 20 | UJC | 10 | U | 10 | U | 5 | U | 5 | UJC |
| 1,1-DICHLOROETHANE | 5 | U | 50 | U | 20 | U | 10 | U | 10 | U | 5 | U | 5 | U |
| 1,1-DICHLOROETHENE | 5 | U | 50 | U | 20 | U | 10 | U | 10 | U | 5 | U | 5 | U |
| 1,2-DICHLOROETHANE | 5 | U | 50 | U | 20 | UJC | 10 | U | 10 | U | 5 | U | 5 | UJC |
| 1,2-DICHLOROETHENE (TOTAL) | 33 | | 33 | J | 38 | | | | 10 | U | 5 | U | 1 | J |
| 2-BUTANONE | 10 | U | 100 | U | 40 | U | | | 10 | U | 10 | U | 10 | U |
| ACETONE | 4 | J | 30 | J | 40 | U | | | | | 5 | J | 10 | U |
| BROMODICHLOROMETHANE | 5 | U | 50 | U | 20 | UJC | 10 | U | 10 | U | 5 | U | 5 | UJC |
| CARBON DISULFIDE | 5 | U | 50 | U | 20 | U | | | | | 5 | U | 5 | U |
| CHLOROBENZENE | 5 | U | 50 | U | 20 | U | 10 | U | 10 | U | | | 5 | U |
| CHLOROFORM | 3 | J | 50 | U | 12 | J | 10 | U | 10 | U | 5 | U | 5 | U |
| METHYLENE CHLORIDE | 3 | J | 38 | J | 22 | | 10 | U | 7 | J | 3 | J | 6 | |
| TETRACHLOROETHENE | 22 | | 20 | J | 78 | | 10 | U | 10 | U | | | 5 | U |
| TOLUENE | 5 | U | 50 | U | 20 | U | 10 | U | 10 | U | | | 5 | U |
| TRANS-1,3-DICHLOROPROPENE | 5 | U | 50 | U | 20 | U | 10 | U | 10 | U | 5 | U | 5 | U |
| TRICHLOROETHENE | 350 | | 290 | | 690 | | 10 | U | 10 | U | 5 | U | 6 | |
| VINYL CHLORIDE | 10 | U | 100 | U | 40 | U | 10 | U | 10 | U | 10 | U | 10 | U |

PLANT 1 - COMPARISON OF HISTORICAL ANALYTICAL RESULTS
VOCs DETECTED IN GROUNDWATER
(UNITS IN UG/L)

[illegible]

TABLE 3-12
PLANT 1 - COMPARISON OF HISTORICAL ANALYTICAL RESULTS
VOCs DETECTED IN GROUNDWATER
(UNITS IN UG/L)

| | 1GW9(87)DL | | 1GW9(92) | | 2GW1(84) | | 2GW1(86) | | 2GW1(87) | | 2GW1(92) | | 2GW2(85) | |
|----------------------------|------------|---|----------|-----|----------|----|----------|---|----------|---|----------|-----|----------|---|
| 1,1,1-TRICHLOROETHANE | 25000 | U | 1500 | JC | 10 | U | 10 | U | 5 | U | 5 | U | 10 | U |
| 1,1,2,2-TETRACHLOROETHANE | 25000 | U | 3000 | UJC | 10 | U | 10 | U | 5 | U | 5 | UJC | 10 | U |
| 1,1-DICHLOROETHANE | 25000 | U | 920 | J | 10 | U | 10 | U | 5 | U | 5 | U | 10 | U |
| 1,1-DICHLOROETHENE | 25000 | U | 3000 | U | 10 | U | 10 | U | 5 | U | 5 | U | 10 | U |
| 1,2-DICHLOROETHANE | 25000 | U | 3000 | UJC | 10 | U | 10 | U | 5 | U | 5 | U | 10 | U |
| 1,2-DICHLOROETHENE (TOTAL) | 25000 | U | 12000 | | | | 2 | J | 5 | U | 5 | U | 10 | U |
| 2-BUTANONE | 50000 | U | 6000 | U | | | 7 | J | 10 | U | 10 | UJC | 10 | U |
| ACETONE | 80000 | | 6000 | U | | | | | 8 | J | 10 | UJC | | |
| BROMODICHLOROMETHANE | 25000 | U | 3000 | UJC | 10 | U | 10 | U | 5 | U | 5 | U | 10 | U |
| CARBON DISULFIDE | 25000 | U | 3000 | U | | | | | 1 | J | 5 | U | 2 | J |
| CHLOROBENZENE | 25000 | U | 3000 | U | 10 | U | 10 | U | | | 5 | U | 10 | U |
| CHLOROFORM | 25000 | U | 3000 | U | 10 | U | 10 | U | 5 | U | 5 | U | 10 | U |
| METHYLENE CHLORIDE | 30000 | | 4000 | | 10 | U | 7 | J | 4 | J | 3 | UJB | 6 | J |
| TETRACHLOROETHENE | 25000 | U | 3000 | U | 10 | U | 10 | U | | | 5 | U | 10 | U |
| TOLUENE | 25000 | U | 3000 | U | 10 | U | 10 | U | | | 5 | U | 10 | U |
| TRANS-1,3-DICHLOROPROPENE | 25000 | U | 3000 | U | 10 | U | 10 | U | 5 | U | 5 | U | 10 | U |
| TRICHLOROETHENE | 110000 | | 71000 | | 10 | UJ | 10 | U | 5 | U | 3 | J | 2 | J |
| VINYL CHLORIDE | 50000 | U | 6000 | U | 10 | U | 10 | U | 10 | U | 10 | U | 10 | U |

PLANT 1 -- COMPARISON OF HISTORICAL ANALYTICAL RESULTS
VOCs DETECTED IN GROUNDWATER
(UNITS IN UG/L)

[illegible]

TABLE 3-12
PLANT 1 - COMPARISON OF HISTORICAL ANALYTICAL RESULTS
VOCs DETECTED IN GROUNDWATER
(UNITS IN UG/L.)

| | 2GW3R(92) | | 3GW1(84) | | 3GW1(86) | | 3GW1(87) | | 3GW1(92) | | 3GW2(85) | | 3GW2(86) | |
|----------------------------|-----------|-----|----------|----|----------|---|----------|---|----------|-----|----------|---|----------|---|
| 1,1,1-TRICHLOROETHANE | 5 | UJS | 10 | U | 10 | U | 5 | U | 5 | U | 10 | U | 2 | J |
| 1,1,2,2-TETRACHLOROETHANE | 5 | UJC | 10 | U | 10 | U | 5 | U | 5 | UJC | 10 | U | 10 | U |
| 1,1-DICHLOROETHANE | 5 | UJS | 10 | U | 10 | U | 5 | U | 5 | U | 10 | U | 10 | U |
| 1,1-DICHLOROETHENE | 5 | UJS | 10 | U | 10 | U | 5 | U | 5 | U | 10 | U | 10 | U |
| 1,2-DICHLOROETHANE | 5 | UJS | 10 | U | 10 | U | 5 | U | 5 | U | 10 | U | 10 | U |
| 1,2-DICHLOROETHENE (TOTAL) | 5 | UJS | | | 10 | U | 5 | U | 5 | U | 10 | U | 2 | J |
| 2-BUTANONE | 10 | UJC | | | 10 | U | 10 | U | 10 | U | 10 | U | 10 | U |
| ACETONE | 10 | UJC | | | | | 26 | U | 10 | UJC | | | | |
| BROMODICHLOROMETHANE | 5 | UJS | 10 | U | 10 | U | 5 | U | 5 | U | 10 | U | 10 | U |
| CARBON DISULFIDE | 5 | UJS | | | | | 5 | U | 5 | U | 10 | U | | |
| CHLOROBENZENE | 5 | UJS | 10 | U | 10 | U | 5 | U | 5 | U | 10 | U | 10 | U |
| CHLOROFORM | 5 | UJS | 10 | U | 10 | U | 5 | U | 5 | U | 10 | U | 10 | U |
| METHYLENE CHLORIDE | 2 | UJB | 10 | U | 7 | J | 4 | J | 1 | J | 4 | J | 4 | J |
| TETRACHLOROETHENE | 5 | UJS | 10 | U | 10 | U | 5 | U | 5 | UJC | 10 | U | 10 | U |
| TOLUENE | 5 | UJS | 10 | U | 10 | U | 5 | U | 5 | U | 10 | U | 10 | U |
| TRANS-1,3-DICHLOROPROPENE | 5 | UJS | 10 | U | 10 | U | 5 | U | 5 | U | 10 | U | 10 | U |
| TRICHLOROETHENE | 10 | JS | 10 | UJ | 12 | | 1 | J | 5 | UJC | 10 | U | 56 | U |
| VINYL CHLORIDE | 10 | UJS | 10 | U | 10 | U | 10 | U | 10 | U | 10 | U | 10 | U |

PLANT 1 - COMPARISON OF HISTORICAL ANALYTICAL RESULTS
VOCs DETECTED IN GROUNDWATER
(UNITS IN UG/L.)

[illegible]

TABLE 3-12
PLANT 1 - COMPARISON OF HISTORICAL ANALYTICAL RESULTS
VOCs DETECTED IN GROUNDWATER
(UNITS IN UG/L)

| | 3GW4(87)DUP | | 3GW4(87)P | | 3GW4(87)PT | | 3GW4(92) | | 3GW4DUP(92) | | 4GW1(85) | |
|----------------------------|-------------|---|-----------|---|------------|---|----------|-----|-------------|-----|----------|---|
| 1,1,1-TRICHLOROETHANE | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 10 | U |
| 1,1,2,2-TETRACHLOROETHANE | | | 5 | U | 5 | U | 5 | UJC | 5 | UJC | 10 | U |
| 1,1-DICHLOROETHANE | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 10 | U |
| 1,1-DICHLOROETHENE | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 10 | U |
| 1,2-DICHLOROETHANE | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 10 | U |
| 1,2-DICHLOROETHENE (TOTAL) | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 10 | U |
| 2-BUTANONE | 10 | U | 10 | U | 10 | U | 10 | UJC | 10 | U | 10 | U |
| ACETONE | 18 | | 10 | U | 10 | U | 10 | UJC | 10 | UJC | | |
| BROMODICHLOROMETHANE | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 10 | U |
| CARBON DISULFIDE | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 23 | |
| CHLOROBENZENE | | | 5 | U | 5 | U | 5 | U | 5 | U | 10 | U |
| CHLOROFORM | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 10 | U |
| METHYLENE CHLORIDE | 3 | J | 6 | B | 5 | B | 1 | UJB | 1 | J | 6 | J |
| TETRACHLOROETHENE | | | 5 | U | 5 | U | 5 | U | 5 | UJC | 10 | U |
| TOLUENE | | | 4 | J | 2 | J | 1 | J | 5 | U | 10 | U |
| TRANS-1,3-DICHLOROPROPENE | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 10 | U |
| TRICHLOROETHENE | 2 | J | 5 | U | 5 | U | 5 | U | 5 | UJC | 10 | U |
| VINYL CHLORIDE | 10 | U | 10 | U | 10 | U | 10 | U | 10 | U | 10 | U |

PLANT 1 - COMPARISON OF HISTORICAL ANALYTICAL RESULTS
VOCs DETECTED IN GROUNDWATER
(UNITS IN UG/L.)

[illegible]

PLANT 1 - COMPARISON OF HISTORICAL ANALYTICAL RESULTS
VOCs DETECTED IN GROUNDWATER
(UNITS IN UG/L.)

[illegible]

TABLE 3-12
 PLANT 1 -- COMPARISON OF HISTORICAL ANALYTICAL RESULTS
 VOCs DETECTED IN GROUNDWATER
 (UNITS IN UG/L.)

| | PWA2(87)PTDL | |
|----------------------------|--------------|---|
| 1,1,1-TRICHLOROETHANE | 370 | |
| 1,1,2,2-TETRACHLOROETHANE | 50 | U |
| 1,1-DICHLOROETHANE | 50 | U |
| 1,1-DICHLOROETHENE | 13 | J |
| 1,2-DICHLOROETHANE | 50 | U |
| 1,2-DICHLOROETHENE (TOTAL) | 50 | U |
| 2-BUTANONE | 100 | U |
| ACETONE | 100 | U |
| BROMODICHLOROMETHANE | 50 | U |
| CARBON DISULFIDE | 50 | U |
| CHLOROBENZENE | 50 | U |
| CHLOROFORM | 50 | U |
| METHYLENE CHLORIDE | 60 | B |
| TETRACHLOROETHENE | 50 | U |
| TOLUENE | 50 | U |
| TRANS-1,3-DICHLOROPROPENE | 50 | U |
| TRICHLOROETHENE | 50 | U |
| VINYL CHLORIDE | 100 | U |

Plant 1 alluvium monitoring Well 1GW7 was selected to be used as a point of comparison, or "background" well, so the inorganics data could be evaluated. This well is more suited for this purpose than other wells at Plant 1 because it is upgradient of nearly all Plant 1 structures and roadways. Inorganics found in one or more wells at concentrations significantly higher than at Well 1GW7 then were identified. Nine inorganics were identified:

- Arsenic
- Barium
- Beryllium
- Chromium
- Lead
- Mercury
- Nickel
- Vanadium
- Zinc

Four of the inorganics—arsenic, chromium, lead, and mercury—were considered to be contaminants of concern. Figures 3-5 and 3-6 show concentrations of these four inorganics in the alluvial and bedrock aquifers beneath Plant 1, respectively. In general, the highest concentrations of most inorganics were detected in bedrock monitoring wells.

Four bedrock wells with consistently high levels of these inorganics were wells GGW4, GGW8, 1GW12, and 1GW13. Arsenic was found at relatively high concentrations in alluvium well 2GW1 (82.6 $\mu\text{g/l}$), and in bedrock wells GGW6 (117 $\mu\text{g/l}$), GGW8 (140 $\mu\text{g/l}$), and 1GW13 (84.6 $\mu\text{g/l}$). The highest levels of chromium were found at bedrock wells GGW4 (144 $\mu\text{g/l}$), GGW8 (363 $\mu\text{g/l}$), 1GW12 (451 $\mu\text{g/l}$), and 1GW13 (203 $\mu\text{g/l}$). The highest levels of lead were found at bedrock wells GGW4 (69.8 $\mu\text{g/l}$), GGW8 (82.3 $\mu\text{g/l}$), 1GW12 (212 $\mu\text{g/l}$), and 1GW13 (74.9 $\mu\text{g/l}$). Mercury was detected at low levels in alluvial wells 1GW11 (0.32 $\mu\text{g/l}$) and PWA2 (0.45 $\mu\text{g/l}$), and bedrock well 1GW12 (0.92 $\mu\text{g/l}$).

Surface-Water and Sediment Contamination

Surface-water samples were collected from four locations along the North Branch Potomac River, adjacent to Plant 1 (Figure 3-7). The samples (except SW-2) were analyzed for TCL VOCs and TAL inorganics. Sample SW-2 was analyzed for VOCs only.

The VOC analytical data for surface-water samples are presented in Appendix A of the Draft RI Report. The surface-water sample collected upstream of Plant 1 (SW-1) contained no detectable VOCs. The surface-water sample collected downgradient from the well cluster 1GW3, 1GW9, 1GW13 (SW-2) contained 9 $\mu\text{g/l}$ of TCE and 4 $\mu\text{g/l}$ of 1,2-DCE. The surface-water sample collected downstream of Site 1 but upstream of Site 2 (SW-3)

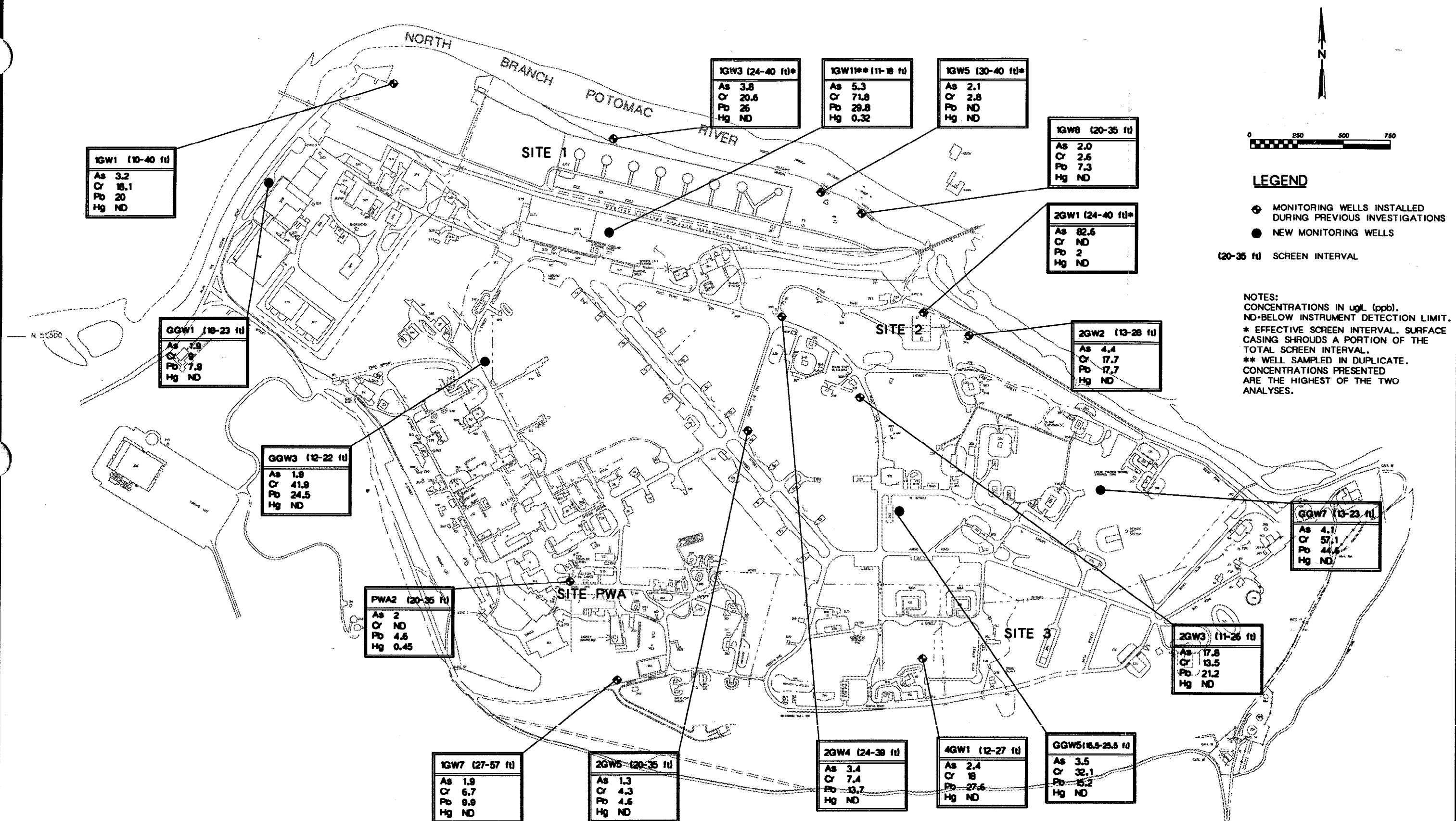


Figure 3-5

PLANT 1-SELECTED METALS CONCENTRATIONS
IN THE ALLUVIAL AQUIFER
ALLEGANY BALLISTICS LABORATORY



00396GB32

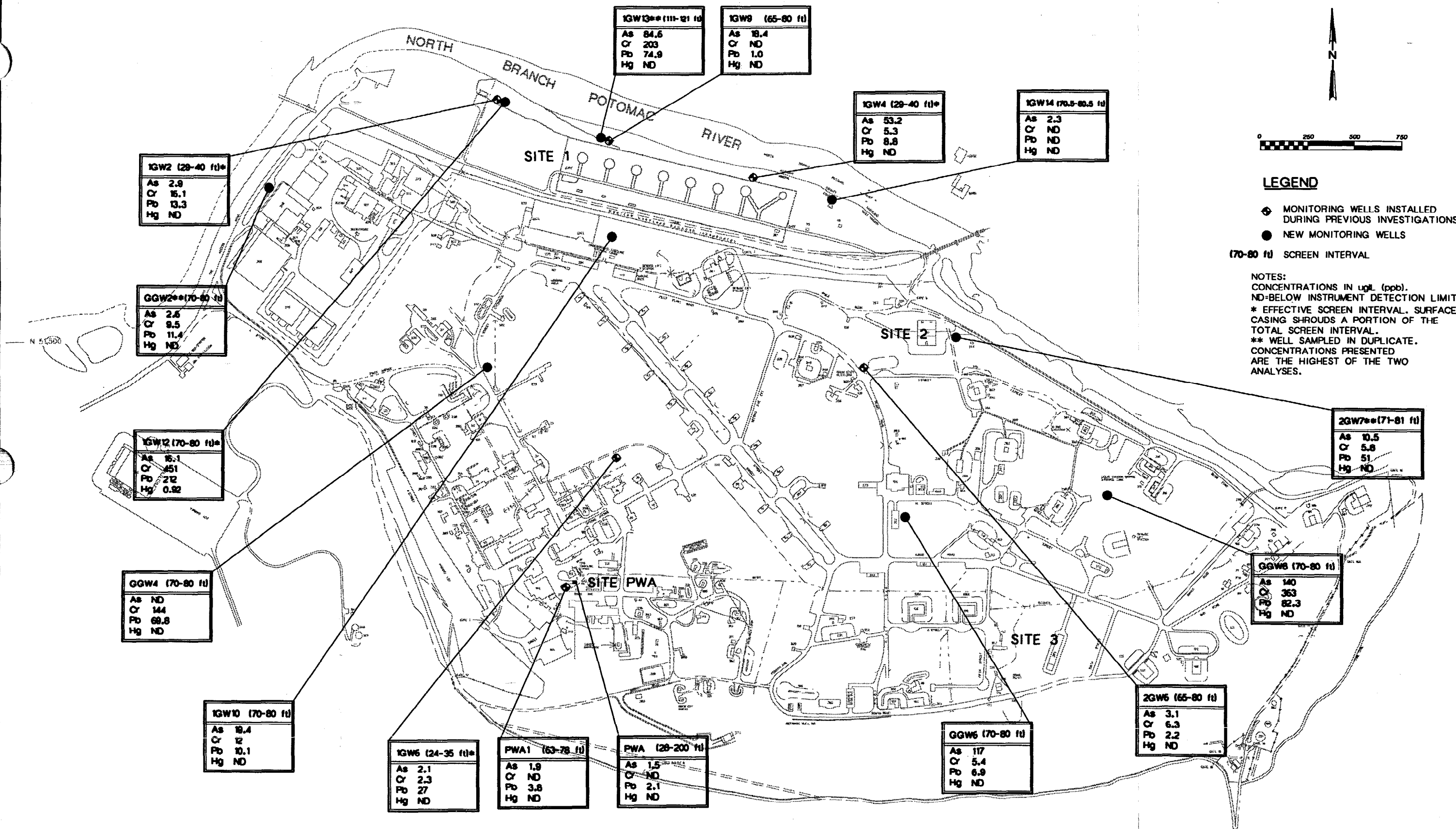
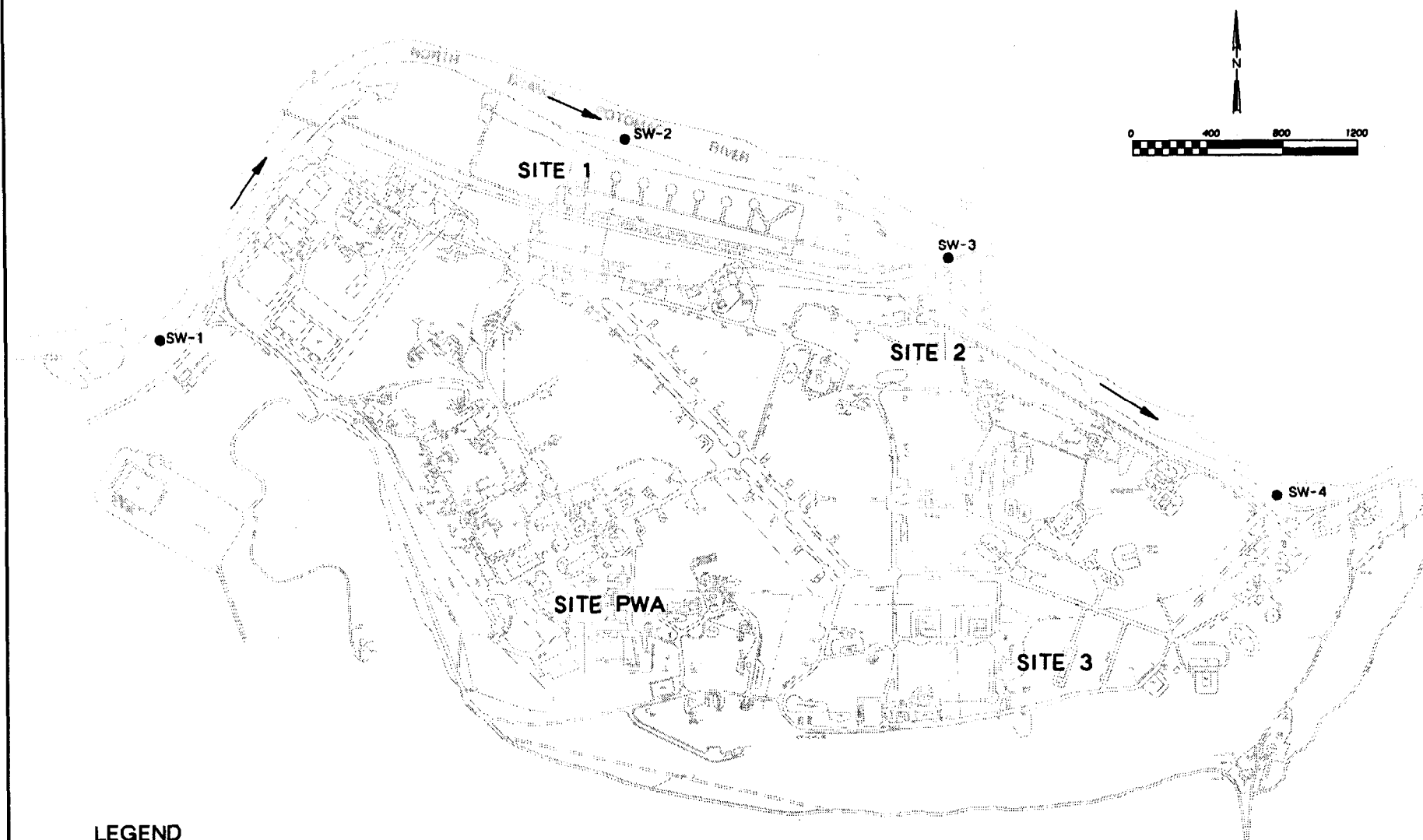


Figure 3-6

PLANT 1-SELECTED METALS CONCENTRATIONS
IN THE BEDROCK AQUIFER
ALLEGANY BALLISTICS LABORATORY





LEGEND

● SURFACE WATER SAMPLING LOCATIONS

→ DIRECTION OF FLOW

Figure 3-7
SURFACE WATER
SAMPLING LOCATIONS
ALLEGANY BALLISTICS LABORATORY

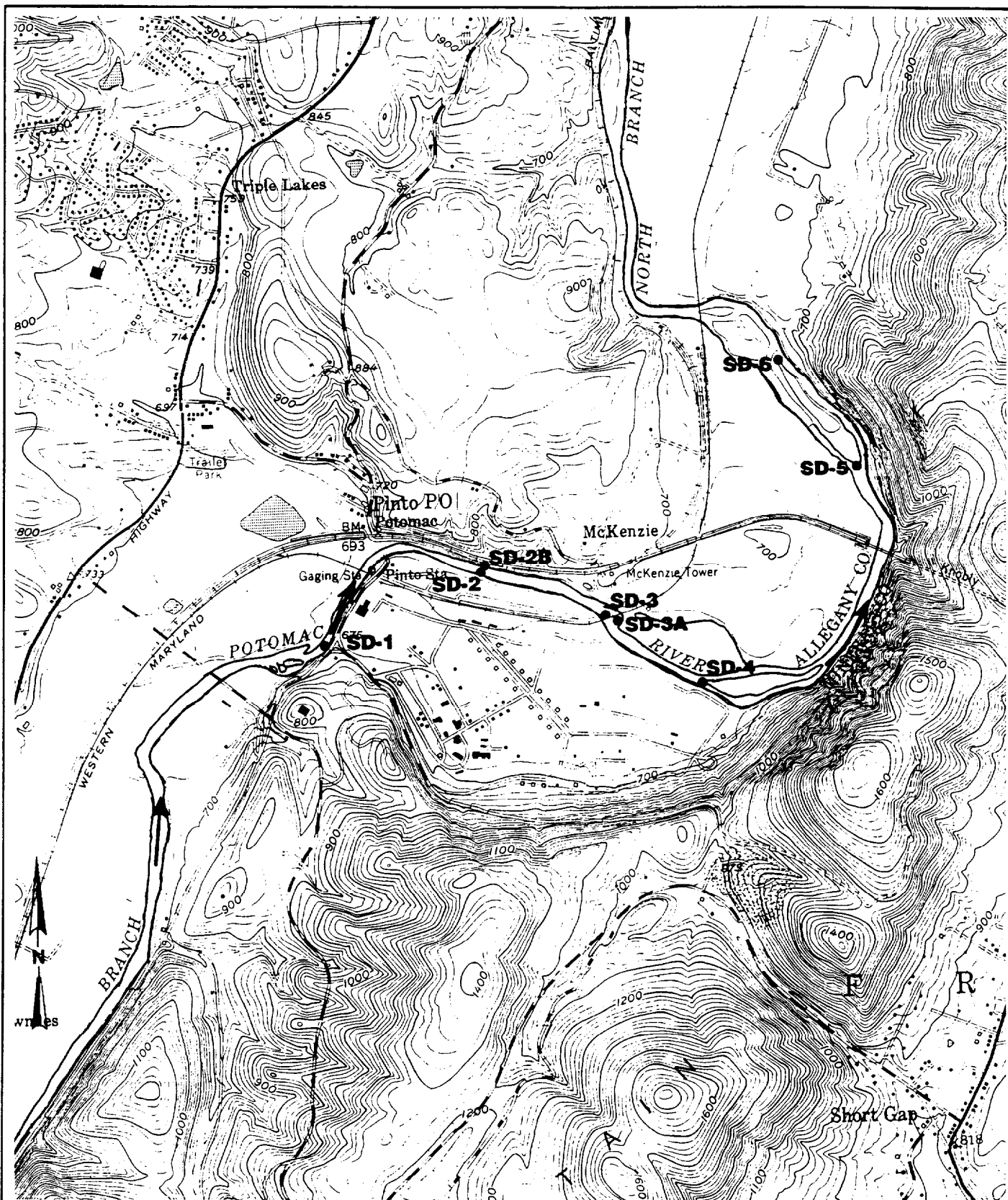


contained TCE (6 $\mu\text{g/l}$), 1,2-DCE (10 $\mu\text{g/l}$), and methylene chloride (1 $\mu\text{g/l}$). The surface-water sample collected near the downstream end of Plant 1 contained TCE at a concentration of 2 $\mu\text{g/l}$, 1,2-DCE at a concentration of 4 $\mu\text{g/l}$, and methylene chloride at a concentration of 2 $\mu\text{g/l}$.

Sediment samples were collected during two sampling events as part of the RI. Initially, only one sediment sample (SD-2) was collected in July 1992, and analyzed for TCL VOCs and TAL inorganics. Analytical results for this sample indicated concentrations of TCE, vinyl chloride, and 1,2-DCE of 460 $\mu\text{g/L}$, 1,700 $\mu\text{g/L}$, and 12,000 $\mu\text{g/L}$, respectively. For this reason, additional sediment samples were collected and analyzed for TCL VOCs in November 1992. Figure 3-8 gives the location of all sediment samples collected and Table 3-13 gives the analytical results for all VOCs detected in the sediment samples. Table 3-14 explains all EPA-defined qualifiers and sample number suffixes used in all analytical data tables.

In general the second sediment sampling event indicated lower levels of VOCs in sediment samples collected along Site 1. No vinyl chloride, methylene chloride, 1,2-DCE, or TCE were detected in sample SD-2 during the second sampling event. SD-1 was collected up river from Site 1 and only acetone was detected. In general VOC concentrations decreased in samples collected down river from Site 1. No VOCs were detected in the most down river sample (SD-6).

WDCR811/009.WP5



Basemap: USGS 7.5 minute Cresaptown, WV-MD quadrangle map.

0 1000 2000

Scale in Feet

LEGEND

- Sediment sample location
- Direction of flow

Figure 3-8
SEDIMENT SAMPLE LOCATIONS COLLECTED
DURING REMEDIAL INVESTIGATION
Allegany Ballistics Laboratory



Table 3-13
VOLATILE COMPOUNDS DETECTED IN SEDIMENT SAMPLES AT SITE 1

| Volatile Compound | Sediment Sample Concentrations ($\mu\text{g/Kg}$) | | | | | | | | |
|---|---|----------------|----------------|-------|------|-------|------|------|------|
| | SD-1 | SD-2 (7/18) | SD-2 (11/9) | SD-2B | SD-3 | SD-3A | SD-4 | SD-5 | SD-6 |
| Vinyl Chloride | 21U | 1700J | 16U | 24U | 17U | 12U | 12U | 19U | 12U |
| Methylene Chloride | 21U | 770BJ | 16U | 24U | 3J | 12U | 2J | 2J | 12U |
| Acetone | 21 | 2100U | 40 | 120 | 25 | 19 | 12U | 39 | 12U |
| 1,2-Dichloroethene (total) | 21U | 12000 | 16U | 24U | 6J | 12U | 12U | 19U | 12U |
| 2-Butanone | 21U | 2100U | 9J | 30 | 10J | 12U | 12U | 11J | 12U |
| Trichloroethene | 21U | 460J | 16U | 10J | 17U | 12U | 3J | 19U | 12U |
| Toluene | 21U | 1100U | 16U | 24U | 17U | 12U | 12U | 19U | 12U |
| <p>U - The contaminant was analyzed for but was not detected. The associated numerical value is the estimated detection limit.</p> <p>J - Estimated value detected below the detection limit.</p> <p>B - Contaminant was detected in the method blank, value suspect.</p> | | | | | | | | | |

WDCR811/011.WP5

Table 3-14
EXPLANATION OF EPA-DEFINED QUALIFIERS
AND SAMPLE NUMBER SUFFIXES FOR ANALYTICAL DATA
Page 1 of 2

Sample Name Suffixes

The following suffixes have been applied to selected sample names in the groundwater analytical data. They are defined as follows:

- DUP - Duplicate Sample
- DL - Dilution Run
- ON - Soil Sample Analyzed by Onsite Mobile Laboratory
- R - Rerun

EPA Qualifiers

- U - The material was analyzed for, but was not detected. The associated numerical value is the estimated detection limit.
- R - Quality Control indicates that data is not usable (i.e., compound may or may not be present). Resampling and re-analysis are necessary to determine the presence or absence of the analyte in the sample.
- J - The associated numerical value is an estimated quantity because quality control criteria were not met. (See descriptors listed below.)

EPA-Approved Descriptor Codes

- B - The reported value is an estimated amount. The compound was detected in the blank and quantity reported in the sample is greater than 5X the amount found in the blank (greater than 10X for "common contaminant" compounds).
- C - The value reported was estimated due to instrument calibration problems.
- D - The sample was diluted.
- E - The value reported was estimated due to interference problems.
- H - The value reported was estimated due to holding time violation.
- I - The value reported was estimated due to internal standard recovery deficiencies.
- M - Benzo(b) and Benzo(k) Fluoranthene not separated due to matrix.
- N - Tentative identification of a compound. Resampling and re-analysis are necessary for verification.

Table 3-14
EXPLANATION OF EPA-DEFINED QUALIFIERS
AND SAMPLE NUMBER SUFFIXES FOR ANALYTICAL DATA
Page 2 of 2

| | | |
|---|---|--|
| P | - | The reported value is the lower of the two (2) reported values on the confirmation and quantitation columns. The difference in reported results on the two columns is $>25\%D$. |
| Q | - | Other QC problems which are specified in the Data Validation Report. |
| S | - | The value reported was estimated due to surrogate or matrix spike recovery problems. |

WDCR665/007.51

Section 4

Work Plan Rationale and Justification

The RI indicates that Site 1 is the largest and most complex site at ABL. Consequently, the highest concentrations and widest variety of contaminants were detected at Site 1. VOCs, particularly TCE, were detected in soil, groundwater, surface water, and sediment samples. For these reasons, the performance of a focused RI/FS at Site 1 has been recommended at ABL.

Figure 4-1 illustrates the conceptual site model for contaminant migration and possible current exposure scenarios at Site 1. The primary sources of contamination are the solvent disposal pits, burning pads, landfills, and the former drum storage area. However, the Draft RI indicates that the solvent disposal pits are the major source of contamination at Site 1. Spent solvents disposed in the pits have contaminated soils and groundwater through infiltration and percolation. The contaminated soils present a risk of exposure through ingestion or dermal absorption and also serve as a secondary source of contamination for groundwater and surface water and sediments. Contaminated groundwater present a risk of exposure through ingestion, inhalation, and dermal absorption. Groundwater also is discharging to the river providing a pathway for contaminating surface water and sediment. Stormwater runoff may also transport contaminated soils to surface water and sediments in the river. However, VOCs are probably not transported by stormwater runoff because of their volatility. SVOCs and metals may be carried by stormwater runoff from the burn pads or landfills directly to the river. Contaminated surface water and sediment present a risk of exposure through ingestion, dermal absorption, and inhalation.

Potential contaminants of concern (PCCs) at Site 1 are different for each medium. PCCs associated with groundwater include VOCs and inorganics, since no explosives or SVOCs were detected in groundwater samples analyzed in previous investigations. PCCs for surface water and sediment include VOCs, SVOCs, and inorganics. VOCs and metals have been detected in surface water and sediment samples analyzed in previous investigations. SVOCs may exist in the waste area and inert burn area landfills. Consequently, runoff may have transported SVOCs to surface water and sediments in the river. PCCs for soils include VOCs, SVOCs, and inorganics. Preliminary remediation goals (PRGs) for groundwater are the maximum contaminant levels (MCLs), PRGs for surface water are the ambient water quality criteria (AWQC), PRGs for sediment and soils are those indicated by the National Oceanographic and Atmospheric Administration (NOAA).

An RI must be sufficient to support a risk assessment and an FS and/or a decision document that addresses applicable or relevant and appropriate requirements (ARARs) and risks for mitigating confirmed contamination at Site 1. Data needs recommended to adequately characterize the geology and hydrogeology, groundwater contamination, soil

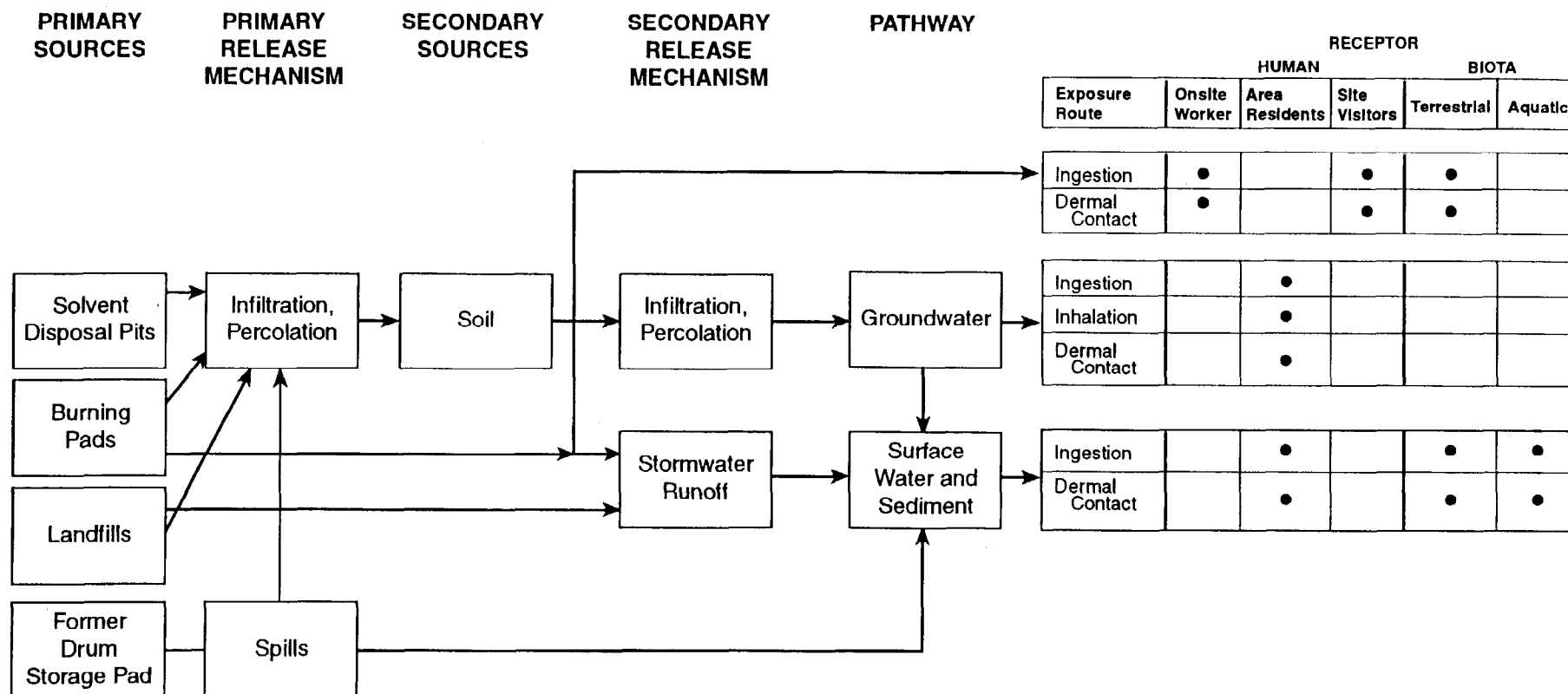


Figure 4-1
 CONCEPTUAL SITE
 MODEL-SITE 1
 Allegany Ballistics Laboratory



contamination, and surface water and sediment contamination in the North Branch Potomac River, are discussed below. The specific scope of work recommended to address these data needs are detailed in Section 5—Technical Approach.

Hydrogeology and Geology

Because the geology at ABL is complex and greatly influences groundwater flow and contaminant migration, additional data needs are targeted at gaining a more comprehensive understanding of the geology and hydrogeology at Site 1 and Plant 1. This information will be useful for characterizing Site 1 in the RI and evaluating remedial alternatives in the FS.

The structural geology at Plant 1 and Site 1 needs more definition. Therefore, more comprehensive data indicating the orientation of bedrock fractures and bedding planes should be collected. This data will be used to develop a site model estimating local groundwater flow directions and contaminant migration at Site 1.

Groundwater Contamination

The primary data gap that requires further investigation at Site 1 is the presence or absence of groundwater contamination across the river from Site 1. VOC contamination detected in bedrock wells 1GW-9 and 1GW-13 suggests the potential for VOCs to migrate beneath the river. The strike of the bedding planes crossing the river and their near vertical dip at Site 1 suggests these bedding planes may provide an avenue for contaminant migration beneath the river. For these reasons, it is important to collect sufficient data to determine whether bedrock groundwater contamination detected at Site 1, particularly VOCs, has migrated beneath the river across from Site 1.

The high concentrations of TCE detected in wells 1GW-3, 1GW-9, and 1GW-13 located downgradient from the solvent disposal pits, suggests the presence of dense nonaqueous phase liquids (DNAPLs). Therefore, additional data should be collected to determine if DNAPLs exist in the groundwater or if DNAPL pools exist at the bedrock surface.

Soil Contamination

In order to complete a risk assessment and FS, additional data should be collected to better define the extent of soil contamination and to evaluate the risk to human health and the environment. In addition, the character and quantity of contaminated soil must be

determined in order to evaluate remedial alternatives in the FS. Specific data needs addressed in the technical approach outlined in Section 5, are identified below.

- Sufficient soil samples should be collected around the solvent disposal pits to better define the extent of VOC contamination. This data will be used to determine the volume of soil requiring remediation.
- Sufficient surface soil samples (0 to 1' depth) should be collected to evaluate risks associated with soil exposure.
- Determine if inorganic contaminants were disposed of in the solvent disposal pits.
- Determine if the open burn area landfill is a source of VOC contamination.
- Determine if the inert burn area ash landfill contains SVOCs.
- Determine the extent of VOC contamination proximate to soil sample locations HCS-BG-98, -113, 102, and 110.

Surface Water and Sediment

The character and extent of contamination in the North Branch Potomac River along Site 1 should be better defined. This information will be used to evaluate the risk to human health and the environment, as well as remedial alternatives in the FS. Therefore, sufficient surface water and sediment samples should be collected to determine the occurrence or extent of VOC, SVOC, and inorganic contamination in surface water and sediment adjacent to and down river from Site 1. In addition, sufficient sediment samples should be collected to determine the taxonomy of benthic organism populations to support the ecological risk assessment.

WDCR811/027.WP5

Section 5

Technical Approach

This section details the technical approach developed to perform the focused RI/FS activities at Site 1. The tasks included in the technical approach are listed below; the remainder of this section provides detailed discussions of each task.

- | | |
|----------|---------------------------------------|
| Task 1: | Work Plan |
| Task 2: | Health and Safety Plan |
| Task 3: | Sampling and Analysis Plan |
| Task 4: | Fracture Trace Analysis |
| Task 5: | Well Installation |
| Task 6: | DNAPL Investigation |
| Task 7: | Well Testing |
| Task 8: | Soil Sampling |
| Task 9: | Soil Gas Sampling |
| Task 10: | Groundwater Sampling |
| Task 11: | Sediment Sampling |
| Task 12: | Surface Water Sampling |
| Task 13: | Laboratory Analysis |
| Task 14: | Data Validation |
| Task 15: | RI Report |
| Task 16: | Baseline Human Health Risk Assessment |
| Task 17: | Baseline Ecological Risk Assessment |
| Task 18: | Feasibility Study |
| Task 19: | Community Relations |
| Task 20: | Proposed Plan |

Task 1: Work Plan

This task consists of the development of this work plan for performing all activities associated with the focused RI/FS at Site 1. The work plan will be developed in accordance with EPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*.

Task 2: Health and Safety Plan

To maintain the health and safety of CH2M HILL employees during all RI/FS activities, a site-specific health and safety plan (HSP) will be developed. The site-specific HSP will be used by CH2M HILL personnel and subcontractors during field activities associated with the project. The HSP will include health and safety assessments to identify problem areas where exposure to hazardous substances in the water, air, or soil may occur.

The assessment will also address safe working procedures, restrictions that will apply to the site work, and potential human exposure to hazardous substances and the toxicological effects of these substances.

Task 3: Sampling Plan

This task consists of the preparation of a Sampling Plan, which is comprised of a Field Sampling Plan (FSP), a Quality Assurance Project Plan (QAPP), and an Investigation Derived Waste (IDW) Management Plan. The sampling plan will be prepared in compliance with all requirements of the U.S. Navy QA/QC Program Manual.

The FSP will be used during field activities, providing guidance for all fieldwork by describing in detail the procedures for sampling and data collection. The FSP will include the following sections: Site Background, Sampling Objectives, Sample Locations and Frequency, Sample Designations, Sampling Equipment and Procedures, and Sample Handling and Analysis.

The QAPP will include a description of field quality assurance and quality control (QA/QC) procedures mandated by the EPA and the U.S. Navy QA/QC Program Manual.

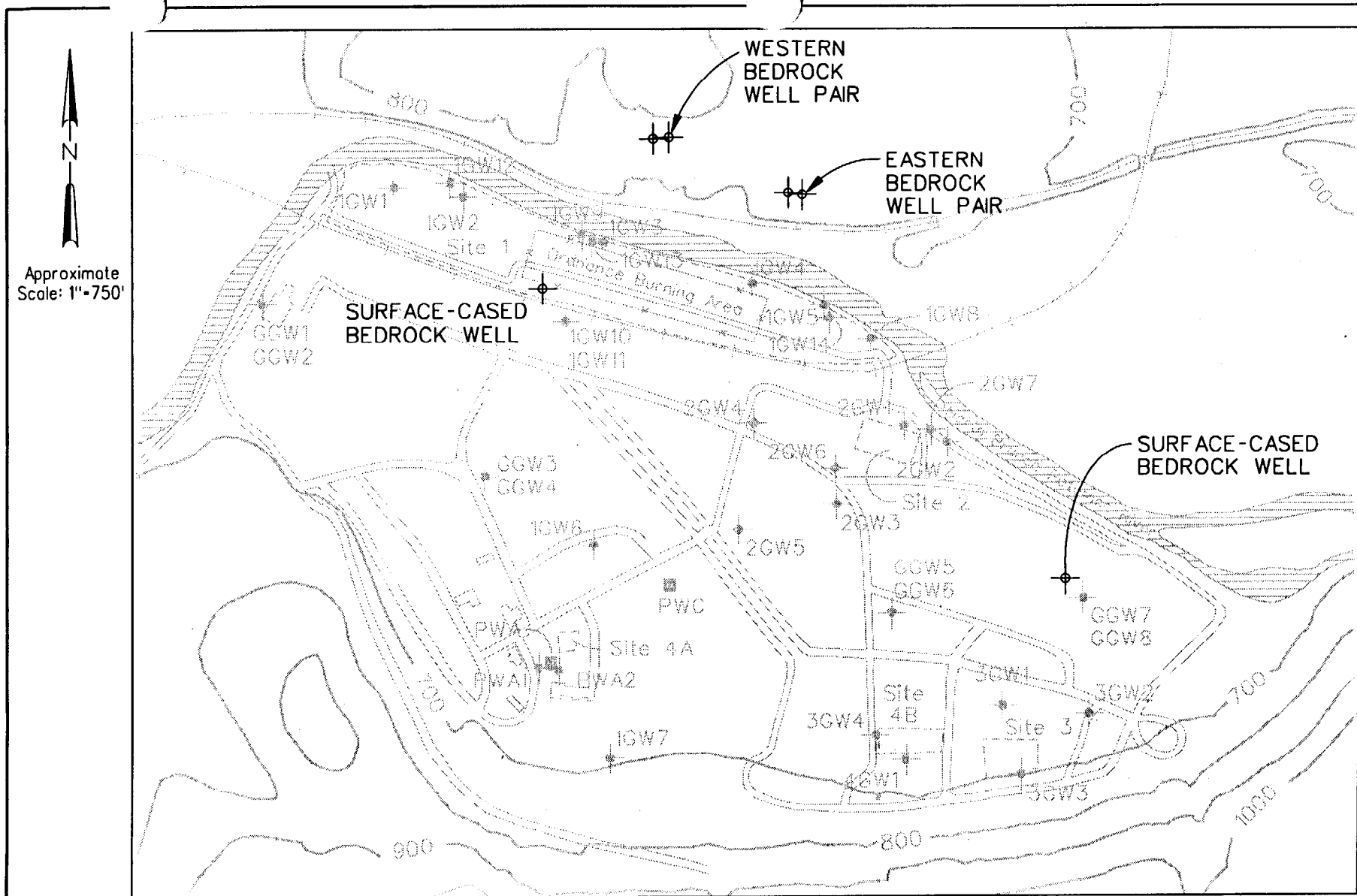
The IDW Management Plan will detail the handling and disposal of all IDWs generated during the focused RI/FS at Site 1. The plan includes a discussion presenting the logic and rationale used in arriving at the recommended disposal procedures.

Task 4: Fracture Trace Analysis

Three stereo pairs of aerial photographs will be obtained and used to perform a fracture trace analysis focusing on the vicinity of Site 1. The objective is to further define the extent of vertical fracturing in the west end of Site 1 and the orientation of fracturing in the east end of Site 1.

Task 5: Well Installation

Two pairs of bedrock wells will be installed across the river from Site 1. Figure 5-1 gives the approximate well locations. Each well pair will include a deep and intermediate depth bedrock well. The intent is to install each well pair at elevations approximately equal to those of wells 1GW-9 & 1GW-13 screened at 80 and 121 feet respectively. Therefore, accounting for the increase in ground elevation across the river (approximately 160 feet at the western location and 110 feet at the eastern location) the depth of the wells is estimated at 300 feet for the western deep bedrock well and 250 feet for the eastern deep bedrock



Approximate
Scale: 1"=750'

LEGEND

- Production Well
- Approximate Site Boundaries

- 1GW3 • Existing Monitoring Well & Designation
- ✦ Proposed Monitoring Well
- 900 — Topographic Contour (Elevation in ft above msl)
- +— Railroad
- - - - - Fence

Figure 5-1
LOCATIONS OF PROPOSED
MONITORING WELLS
Allegany Ballistics Laboratory



well and 240 feet for the western intermediate bedrock well and 190 feet for the eastern intermediate bedrock well. Conservatively, the deep wells will be an additional 20 feet below the screen depth of 1GW-13. All four wells will be 4 inches in diameter. Core sampling will be performed using the wire-line coring technique for the bottom 140 feet of each deep bedrock well to help characterize the lithology and fracture distribution at these depths and locations. Each well will be installed using air rotary drilling techniques.

Two bedrock wells will be installed on Plant 1. One will be installed proximate to GGW-8 at a depth of 80 feet and one will be located south of the solvent disposal pit directly along strike as determined from the fracture trace analyses at a depth of 120 feet. Core sampling will be performed for the entire depth of each well using the wire-line coring technique. Each well will be installed using Odex drilling techniques to install the surface casing and air rotary to ream the bedrock after coring.

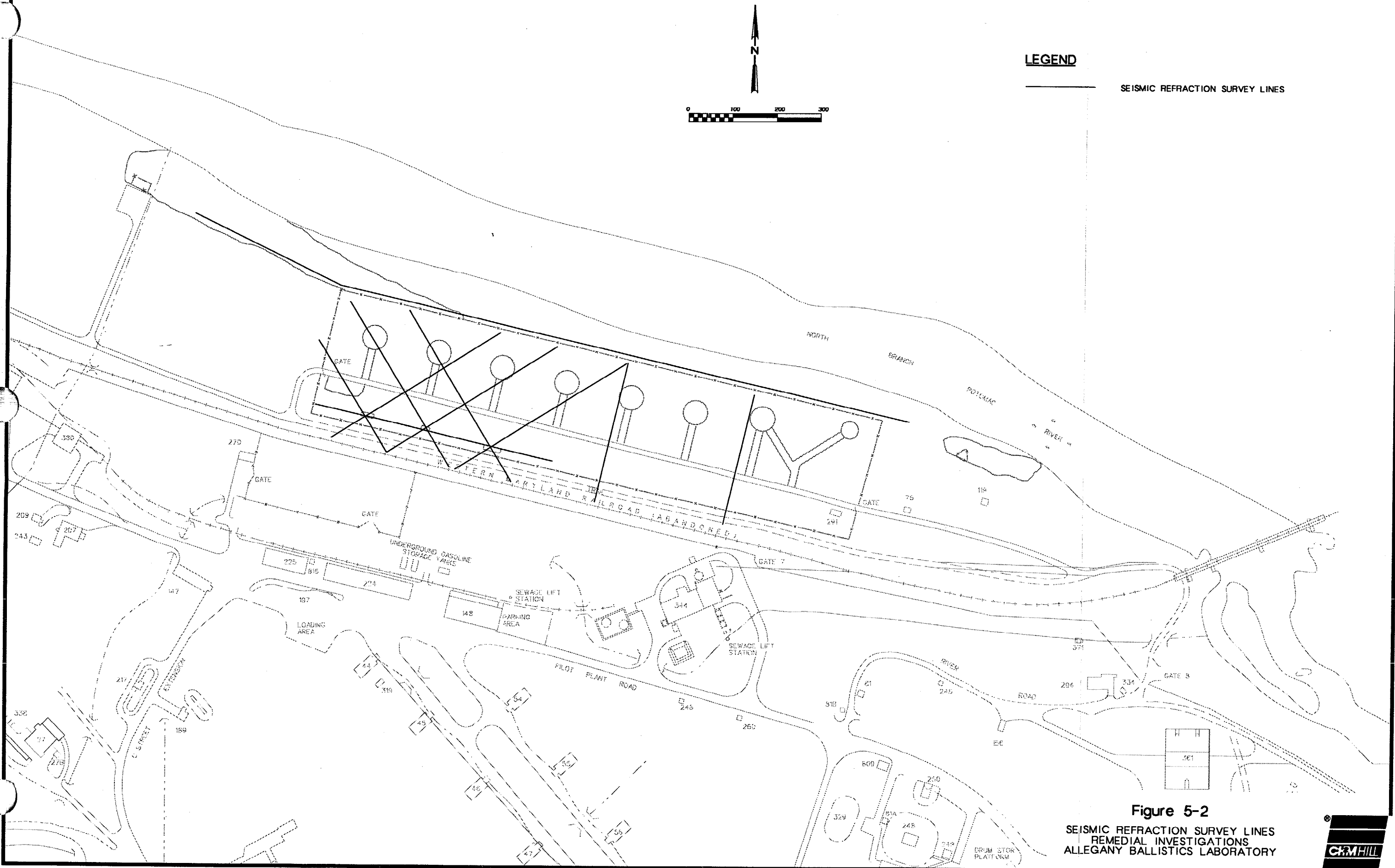
Task 6: DNAPL Investigation

The DNAPL investigation includes seismic refraction surveying and soil borings. The purpose of the seismic refraction survey is to provide a contour map of bedrock depths beneath the site suitable for use in identifying bedrock surface channels or basins which might affect the migration or capture of dense non-aqueous phase liquids (DNAPLs).

Seismic refraction is used to perform profiling of subsurface density contrasts such as the top-of-bedrock. The principles of the seismic refraction technique generally involve measuring the travel times of shock waves from a surface source, down to the tip-of-bedrock or other density contrast, and back to the surface. Eleven seismic refraction profiles will be recorded at the locations depicted on Figure 5-2.

The seismic refraction field survey includes the following specific tasks:

- A Geometrics ES-2401 seismograph will be used to record seismic travel times at Mark Products 4.5 Hertz geophones spaced at 10-foot intervals along successive 240-foot geophone spreads comprising the seismic lines.
- Travel times are recorded for shot points located 10 feet off of each end of each spread, and at each spread mid-point. Seismic waves are generated using a Betsy Seisgun with 12 gauge, 165 grain black powder blank loads.
- Seismic waveform data are recorded for each geophone on the internal hard drive of the seismograph, and transferred twice-daily to diskette for back-up.



LEGEND

SEISMIC REFRACTION SURVEY LINES

Figure 5-2
SEISMIC REFRACTION SURVEY LINES
REMEDIAL INVESTIGATIONS
ALLEGANY BALLISTICS LABORATORY



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Subsequent processing and interpretation of the seismic refraction data will include the following tasks:

The seismic refraction data are analyzed using the SIP family of computer programs developed for the U.S. Geological Survey by Rimrock Geophysical. The processing sequence is described below:

- First arrival travel times or first breaks are selected on the waveform data using the automatic picking routine SIPIK (with occasional minor manual adjustment) to ensure consistent and objective picking.
- T-X graphs are compiled from the travel time data for each line using the routine SIPIN.
- The T-X graphs are analyzed using the inversion program SIPT2. SIPT2 uses a seismic ray tracing algorithm to calculate the least squares best-fitting set of multiple undulating refractor surfaces or density contrasts for the T-X data from each seismic line.
- The X-Y coordinates of each geophone and shot point are compiled with the corresponding inferred bedrock refractor depths and input to the statistical kriging routine in SURFER by Golden Software to produce contours of the inferred bedrock refractor depth.

Soil borings will be drilled at depressions in the bedrock surface, identified by the seismic survey, where DNAPL pools may exist. It is estimated that three borings will be drilled to a depth of 25 feet. Split-spoon samples will be collected to determine if DNAPLs occur at these locations. In addition, wells 1GW3, 1GW9, and 1GW13 will be sampled using a stainless steel bailer and a water insoluble dye will be mixed with the sample to detect the presence of DNAPLs. If DNAPLs are detected they will be subjected to comprehensive analyses.

Task 7: Well Testing

The two deep bedrock wells installed across the river and the well installed south of the disposal pits will be tested before placing the casing in each. The testing includes: packer testing at five different intervals, a down-hole camera survey, caliper testing, natural gamma and electrical resistivity testing, and fluid resistivity and temperature testing. Each of these tests will be conducted over the full length of the borehole in bedrock. One groundwater sample will be collected at each of the five packer intervals for a total of five

samples per well. All fifteen samples will be analyzed for seven targeted VOCs using a field GC. These include:

- TCE
- 1,1,1-TCA
- 1,1-DCE
- 1,1-DCA
- cis 1,2-DCE
- trans 1,2-DCE
- methylene chloride

The well screen will be placed at the packer interval where the highest concentration of VOCs are detected. If no VOCs are detected the well will be screened at the bottom 20 feet of the well.

Task 8: Soil Sampling

The soil sampling program recommended for Site 1 is outlined below. Sample locations are shown in Figure 5-3. All samples will be collected using a geoprobe, a stainless steel hand auger, or a stainless steel trowel.

- One soil sample will be collected immediately downslope from the drum storage pad at a depth of 3-4 feet. The sample will be analyzed for VOCs only at the offsite laboratory. The sample will not be analyzed for other compounds since the objective is to confirm previous field GC results generated during the Phase I RI and because the storage pad only stored solvents. Because no VOCs were detected during previous investigations, a past release is unlikely and metals and SVOCs possibly associated with spent solvents were probably not released either. Therefore, the samples will not be analyzed for these compounds.
- One soil sample will be collected from the historical bottom of each solvent disposal pit for a total of three samples. The samples will be analyzed at the offsite laboratory for inorganics included on EPA's target analyte list (TAL).

The objective of the sampling is to determine if the spent solvents disposed in the pits contained inorganics and consequently were released. Because soil samples collected from these locations have already been analyzed for compounds included on the TCL they will only be analyzed for TAL inorganics.

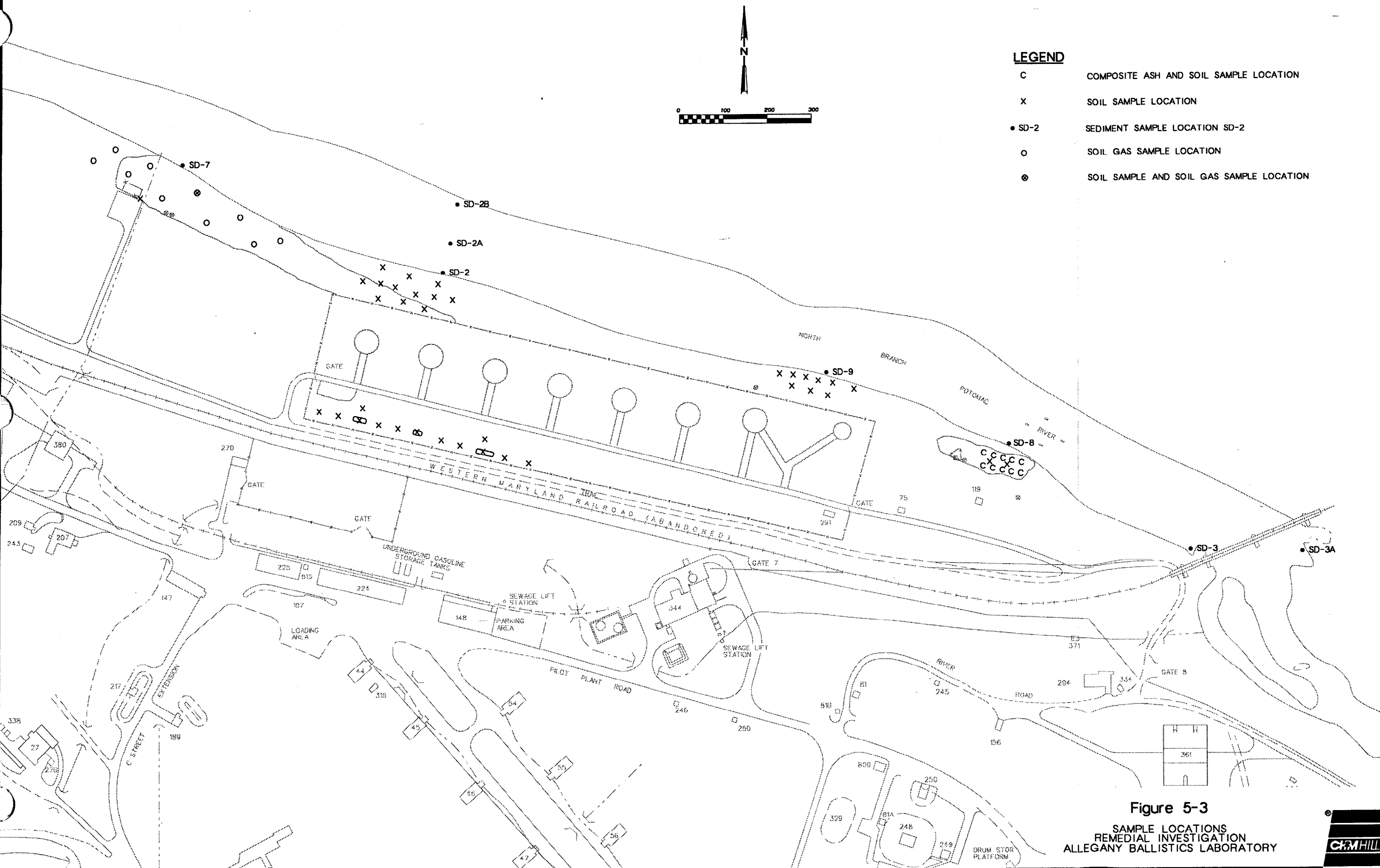


Figure 5-3
SAMPLE LOCATIONS
REMEDIAL INVESTIGATION
ALLEGANY BALLISTICS LABORATORY



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- Twenty soil samples will be collected at 10 different locations about the eastern and western solvent disposal pits as determined in the field. Two samples will be collected at each location at depths of 3-4 feet and 9-10 feet. The samples will be analyzed for VOCs. All samples will be analyzed for the seven targeted VOCs with the field GC and four samples will be analyzed for VOCs included on the TCL at the offsite laboratory.

The objective of the sampling is to better estimate the extent of VOC soil contamination about the solvent disposal pits. For this reason, the samples will be analyzed for targeted VOCs with the field GC and four (twenty percent) of these samples will be split and sent to the offsite laboratory and analyzed for VOCs as a QA/QC procedure.

- Ten surface soil samples will be collected at the following sample locations; HCS-BG-8, -4, -33, -34, -10, -56, -16, -84, -23, and -25 identified in Figure 4-1 of the draft RI Report. These samples will be analyzed for VOCs included on EPA's TCL by the offsite laboratory and used in the risk assessment to evaluate exposure to surface soils.

The objective of collecting these surface soil samples is to provide surface soil data on VOC contamination to be evaluated in a risk assessment. Results of the Phase I RI (p. 7-1 Draft RI) and the understanding of past disposal practices (p. 3-6 Draft RI and IAS Report) does not warrant analysis of other compounds.

- One ash composite sample and one soil composite sample will be collected from the inert burn area landfill along the river at the eastern end of the site. In addition, two grab soil samples and two grab ash samples will be collected. All samples will be analyzed for EPA's TCL SVOCs by the offsite laboratory.

The objective of collecting these samples is to determine if SVOCs occur in the soil and ash in the inert burn area landfill. Soil and ash samples collected from this area during the Phase I RI were analyzed for TCL VOCs, TAL metals, and dioxin, but not SVOCs. Therefore, the samples will be analyzed for SVOCs only.

- Four surface soil samples will be collected within Plant 1 at locations to be determined and analyzed for EPA's TAL inorganics by the offsite laboratory. The samples will be evaluated for use as a background samples for inorganics.

The objective of collecting these samples is to evaluate whether background soil samples can be used for comparing inorganic concentrations detected in site soil samples. This is done to account for naturally occurring inorganics in the soil. The samples will not be analyzed for compounds included on

the TCL since they are generally not considered to be naturally occurring in background soils.

- A total of 10 soil samples will be collected from a depth of 2-3 feet along three transects about sample locations HCS-BG-98 and -113. The objective is to better define the extent of VOC soil contamination detected at these two sampling locations during the RI. Therefore, the samples will only be analyzed for TCL VOCs.
- A total of 7 soil samples will be collected from a depth of 2-3 feet along two transects about sample locations HCS-BG-102 and -110. The objective is to better define the extent of VOC soil contamination detected at these two sampling locations during the RI. Therefore, the samples will be analyzed for TCL VOCs only.
- One surface soil sample will be collected from each of the sample locations HCS-BG-98, -102, -110, and -113, for a total of four samples. The objective is to determine if SVOC or metal contamination is associated with the VOC contamination detected at these locations, and to provide data to be used in evaluating risk associated with soil exposure in the risk assessment. Therefore, the samples will be analyzed for VOCs, SVOCs, and inorganics plus cyanide.
- One soil sample will be collected at the soil gas sample location containing the highest concentration of VOCs. The sample will be collected from a depth of 2-4 feet and analyzed for VOCs, SVOCs, and TAL metals plus cyanide.

Task 9: Soil Gas Sampling

Ten soil gas probes will be emplaced in the open burn area landfill at a depth of 3-4 feet. Soil gas samples will be collected and analyzed for VOCs using a field GC. Other contaminants are not anticipated to be found in soil gas samples simply because of their low volatility.

Task 10: Groundwater Sampling

The groundwater sampling program at Site 1 is outlined below:

- One groundwater sample will be collected from each of the six new wells and analyzed for TCL VOCs and dissolved TAL inorganics plus cyanide by the offsite laboratory. The samples will not be analyzed for SVOCs or explosives since these compounds were not detected in groundwater samples

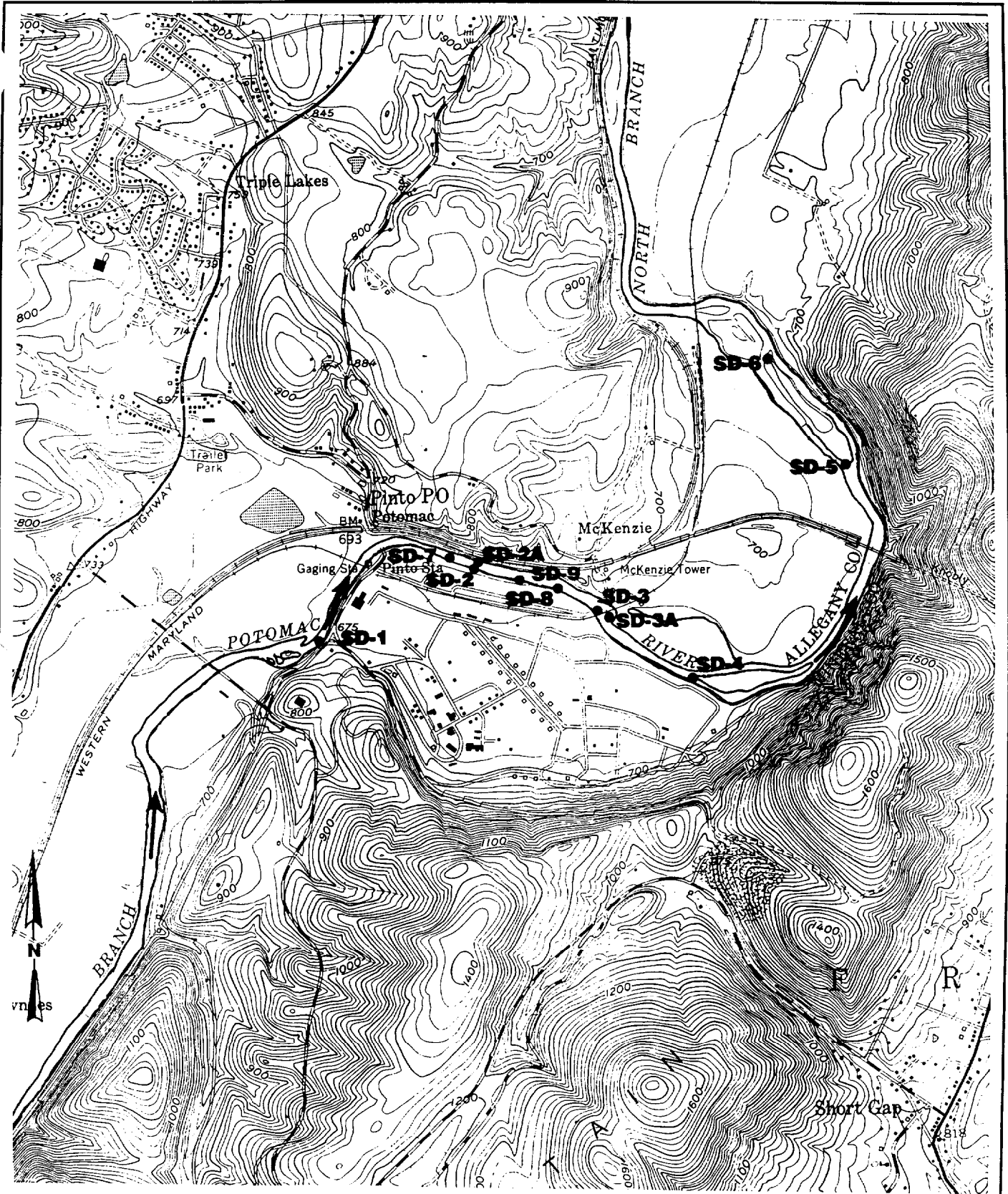
collected during the Interim RI or Phase I RI. In addition, PCBs/pesticides were not used at Site 1.

- One groundwater sample will be collected from wells 1GW1, 1GW2, 1GW3, 1GW4, 1GW10, 1GW11, 1GW12, and 1GW13 and analyzed for TCL VOCs and total and dissolved TAL inorganics plus cyanide by the offsite laboratory (see Figure 5-1). The samples will not be analyzed for SVOCs or explosives since these compounds were not detected in groundwater samples collected during the interim RI or the Phase I RI. In addition, PCBs/pesticides were not used at Site 1.
- One groundwater sample will be collected from wells 1GW9, 1GW14, 1GW5, and 1GW8 and analyzed for TCL VOCs by the offsite laboratory. The objective is to determine if VOC levels detected in previous investigations have changed. The samples will not be analyzed for SVOCs or explosives since these compounds were not detected in groundwater samples collected during the interim RI or the Phase I RI. In addition, PCBs/pesticides were not used at Site 1.
- One round of water level measurements will be taken for all new and existing wells at Plant 1 within a 10-hour period.

Task 11: Sediment Sampling

Figures 5-3 and 5-4 give the sediment sampling locations of all samples collected during the Phase I RI and locations where samples will be collected as part of this effort. The sediment sampling program at Site 1 is outlined below:

- Four sediment samples will be collected from sample locations SD-4, SD-9, SD-7, and SD-8 and analyzed for TCL VOCs and SVOCs and TAL inorganics plus cyanide by the offsite laboratory. The samples will not be analyzed for PCBs/pesticides since they were not used at Site 1.
- One sediment sample will be collected from sample location SD-1 and analyzed for TAL inorganics and TCL SVOCs by the offsite laboratory. This sample will serve as an upstream background sample. It will not be analyzed for VOCs because VOC analysis of sediment collected from this location during the RI (p. 7-27 Draft RI Report) did not detect VOCs.
- Two sediment samples will be collected from sample locations SD-2 and SD-2A. They will be analyzed for VOCs only to compare previous VOC results with new results since high concentrations of VOCs were detected at these locations during the Phase I RI.



Basemap: USGS 7.5 minute Cresaptown, WV-MD quadrangle map.

0 1000 2000

Scale in Feet

LEGEND

- Sediment sample location
- Direction of flow

Figure 5-4
SEDIMENT SAMPLE LOCATIONS
REMEDIAL INVESTIGATION
Allegheny Ballistics Laboratory



Task 12: Surface Water Sampling

The surface water sampling program at Site 1 is outlined below:

- Two surface water samples will be collected from sediment sample locations SD-2 and SD-2A. Both samples will be analyzed for TCL VOCs by the offsite laboratory.

The objective of the surface water sampling at these locations is to compare VOC analytical results of surface water samples taken from location SD-2 during the Phase I RI. Therefore, the sample will be analyzed for VOCs only.

- One sample will be collected from sediment sample location SD-1 and along the open burn area landfill (SD-7) and the inert burn area landfill (SD-8) for a total of three samples. All three samples will be analyzed for TCL SVOCs and TAL inorganics by the offsite laboratory.

The objective of this sampling is to determine if the inert burn area or open burn area landfills have released inorganics or SVOCs to the surface water through runoff. Analysis is not performed for VOCs because they would not likely be transported through this pathway. Analysis is not performed for PCBs/pesticides since they were not used at Site 1.

Task 13: Laboratory Analysis

All offsite analyses of soil, sediment, groundwater, and surface water samples will be conducted at CEIMIC laboratory in Narragansett, Rhode Island. CEIMIC fulfills all requirements of the U.S. Navy's QA/QC Program Manual and EPA's Contract Laboratory Program. A signed certificate of analysis will be provided with each laboratory analysis, along with a certificate of compliance certifying that all work was performed in accordance with the applicable federal, state, and local regulations. All analyses will be performed in compliance with NEESA guidance for Level D.

Task 14: Data Validation

All data will be validated before the project staff performs an interpretation. The data validation will be performed by Heartland Environmental Services, Inc., an independent contractor, and will conform to the NEESA guidance for Level D. Data that should be qualified will be flagged with the appropriate symbol. Results for quality assurance/quality control (QA/QC) samples will be reviewed and the data will be qualified further, if necessary. Finally, the data set as a whole will be examined for consistency, anomalous results, and reasonableness.

Task 15: RI Report

A draft and final RI report detailing the investigation activities and findings will be prepared in accordance with the "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (U.S. EPA, 1988 Interim Final). The report will summarize data from previous investigations as well as all new data generated during the focused RI. Nine sections will be included in the RI Report: Executive Summary; Introduction; Background and Physical Setting; Focused Remedial Investigation Activities; Site 1 Geology; Site 1 Hydrogeology; Nature and Extent of Contamination; Contaminant Fate and Transport; and Preliminary ARARs.

Task 16: Baseline Risk Assessment

A baseline risk assessment (RA) will be performed at Site 1. The RA will address contaminants and exposure pathways associated with potential risks to human health. The RA will be quantitative to the extent possible and be conducted in accordance with EPA Region III's supplementary risk assessment guidance documents. On the basis of the current understanding of Site 1, human health risks will be evaluated for exposure through the following pathways:

- Current worker and future residential exposure to ingestion, inhalation of, and dermal absorption of contaminated groundwater will be evaluated.
- Current public exposure through ingestion of and dermal contact with contaminated surface water will be evaluated.
- Current and future worker exposure to ingestion and dermal absorption of contaminated soils will be evaluated.
- Future residential exposure to ingestion and dermal absorption to contaminated soils will be evaluated.

The following will be performed as part of the baseline risk assessment:

- Toxicity assessment—The toxicity assessment will include a brief discussion of the toxicological characteristics of the major contaminants at the site and the quantitative approach used to assess the potential effects on human health, including aggregate effects, of the carcinogenic and systemic toxicants. Summaries of the toxicological effects of the major contaminants will be provided as part of the risk assessment.
- Exposure assessment—The exposure assessment will include a discussion of ways in which identified receptors could come into contact with chemicals at the site. The pathways that will be evaluated are listed above, exposures

through these pathways will be quantified on the basis of the data collection at the site during the focused RI and previous investigations.

- Risk characterization—The risk characterization will include quantifying the potential incremental risks on the basis of information from the toxicity and exposure assessments.

Task 17: Baseline Ecological Risk Assessment

A baseline ecological RA will be performed at Site 1. The RA will evaluate the potential risks to the environment in the absence of any remedial action. Characterization of environmental risks involves identifying the potential exposures to the surrounding ecological receptors and evaluating the potential effects associated with such exposures. The RA will be conducted in accordance with the *Risk Assessment Guidance for Superfund Volumes II: Environmental Evaluation Manual* (U.S. EPA, 1989) and Region III's supplementary risk assessment guidance documents. The scope of the RA is detailed below.

Description of Areas for Ecological Consideration

An ecological investigation will be conducted to describe the habitats potentially impacted at the ABL site. A qualitative description will be prepared, based on existing data from other sources and from a site reconnaissance survey. The description will address a physical description of the site and its surroundings and the identification of habitats in potentially exposed areas.

The site and surrounding area will be characterized through a review of reports provided by the Navy for this site, through contacts with resource agencies having knowledge of environmental resources in the vicinity of the site and the results of the site reconnaissance.

Aquatic Site Reconnaissance Studies

A Rapid Bioassessment (RBA) analysis will be conducted at four stations in the river, including one upstream reference station (SD-1), two onsite stations (SD-2 and SD-8), and one downstream location (SD-4). The objective of the RBA will be to evaluate whether there are potential differences in benthic biota at onsite and reference stations. Station locations with similar physical characteristics will be selected to minimize the potential interference that physical conditions may play when comparing the sampling results. As a component of the RBA and to supplement the RBA results, benthic samples (surber samples) will be collected (two at each station) for taxonomic analysis. The lab will calculate diversity index values and a variety of community measures. This data will be used in conjunction with the results of the RBA results for the RA analysis of contamination effects on benthic organisms.

Terrestrial Onsite Reconnaissance Studies

An inventory of terrestrial species will be conducted in the Site 1 area. Visual observations of vegetation and wildlife will be made via walking transects through the wetland/upland habitats in the Site 1 area of concern. In addition, similar observations will be made in control areas. Species lists and associations of both plant and wildlife will be prepared. Signs of visual stress of plants, unvegetated areas, or unusual wildlife observations also will be noted.

Contaminants of Concern

Analytical results from the previous studies and the water, sediment, and soil sampling and analysis conducted as part of this work plan will be reviewed to select contaminants of concern. Contaminants will be evaluated for the following to help in selecting contaminants of concern:

- toxicity characteristics and action concentration
- bioaccumulation potential in plants and animals
- translocation properties and tissue accumulation
- environmental and within-organism persistence
- potential uptake by aquatic and terrestrial organisms, and
- mode of toxic action.

Exposure Assessment

The objectives of the exposure assessment will be to:

- identify significant pathways/routes of exposure,
- identify habitat types that may receive contaminants,
- identify the plants, fish and/or wildlife that may be potentially exposed to the contaminants of concern,
- select target species, and
- predict exposure concentrations or body burdens of contaminants whenever tissue concentrations are unavailable.

The potential magnitude and frequency of contact with the contaminants through appropriate pathways for selected species will be evaluated. The first step will be to identify both the pathways of concern specific to the individual areas of concern and the habitats potentially affected by those areas of concern. Factors that will be further evaluated in the pathways selection process include the location of contaminant sources; local topography and geology; surrounding terrestrial and aquatic/wetlands habitats;

prediction of contaminant migration; and persistence and mobility of migrating contaminants.

Target species would be selected using criteria such as species that are important to the well-being of protected species or species considered to be valuable for recreational purposes, species that are critical to the structure and function of the particular ecosystem, species that are sensitive indicators of ecological change, and species or functional groups that are sensitive to the contaminants at the site.

Exposure points will be defined after the potential contaminant migration pathways and affected habitats have been defined and potential target receptors have been identified. Exposure point concentrations will be estimated based on water, soil, and sediments data collected during other tasks.

Toxicity Assessment

The toxicities of the contaminants of concern will be assessed for aquatic life, terrestrial wildlife, and vegetation, where relevant. Scientific literature and regulatory guidelines will be reviewed for media-specific and/or species-specific toxicity data. These data will be used to determine critical toxicity values for the contaminants of concern, which will be compared to media contaminant concentrations or estimated daily intakes. In the absence of toxicological data for target species, critical toxicity values may be derived using data from related species or applying safety factors that reflect interspecies extrapolation.

Risk Characterization

Exposure and toxicity assessment results will be integrated to estimate the potential hazard or risk to ecological receptors. The media concentrations or estimated daily intakes will be compared, where relevant. Ecological effects levels will be compared with maximum concentrations of contaminants. The results will be summarized in an Ecological Risk Assessment Report.

Task 18: Feasibility Study Report

A focused FS report for Site 1 will be developed in accordance with the "Guidance for Conducting remedial Investigations and Feasibility Studies Under CERCLA" (U.S. EPA, 1988 Interim Final). The FS Report will contain an executive summary and five sections. The executive summary will be a brief overview of the FS and the analysis underlying the remedial actions that were evaluated.

The FS will contain the following six sections:

- Section 1—Introduction and Site Background
- Section 2—Remedial Action Objectives

- Section 3—Identification and Screening of Remedial Technologies
- Section 4—Development and Initial Screening of Remedial Alternatives
- Section 5—Description and Detailed Analysis of Alternatives
- Section 6—Comparative Analysis of Alternatives

The introduction will summarize the conclusions of the RI and RA. Section 2 will present and discuss the remedial action objectives and the ARARs. In Section 3, feasible technologies and process options for site remediation will be identified for each remedial action objective and the results of the remedial technologies screening will be described. In Section 4, remedial alternatives will be developed by combining the technologies identified in the previous screening process. The results of the screening of remedial alternatives for effectiveness, implementability, and cost will be described. Each remedial alternative surviving the screening process will be evaluated in detail with respect to each of the evaluation criteria identified in Section 5. A detailed description of the cost and noncost features of each remedial action alternative passing the initial screening will be presented. Section 6 will discuss the advantages and disadvantages of each alternative relative to the others.

Task 19: Community Relations

The intent of the Community Relations (CR) task is to identify community concerns about RI/FS activities at ABL, and to provide opportunities for public involvement in the decision-making process. CR activities will be prepared in accordance with public involvement guidelines of the Office of Solid Waste and Emergency Response (OSWER) Directive 9230.0-3B, *Community Relations in Superfund: A Handbook*, issued by the EPA.

A Community Relations Plan (CRP), tailored to the surrounding communities' expressed concerns, was prepared for the ABL site as part of the RI. As part of this effort the CRP will be updated.

Task 20: Proposed Plan

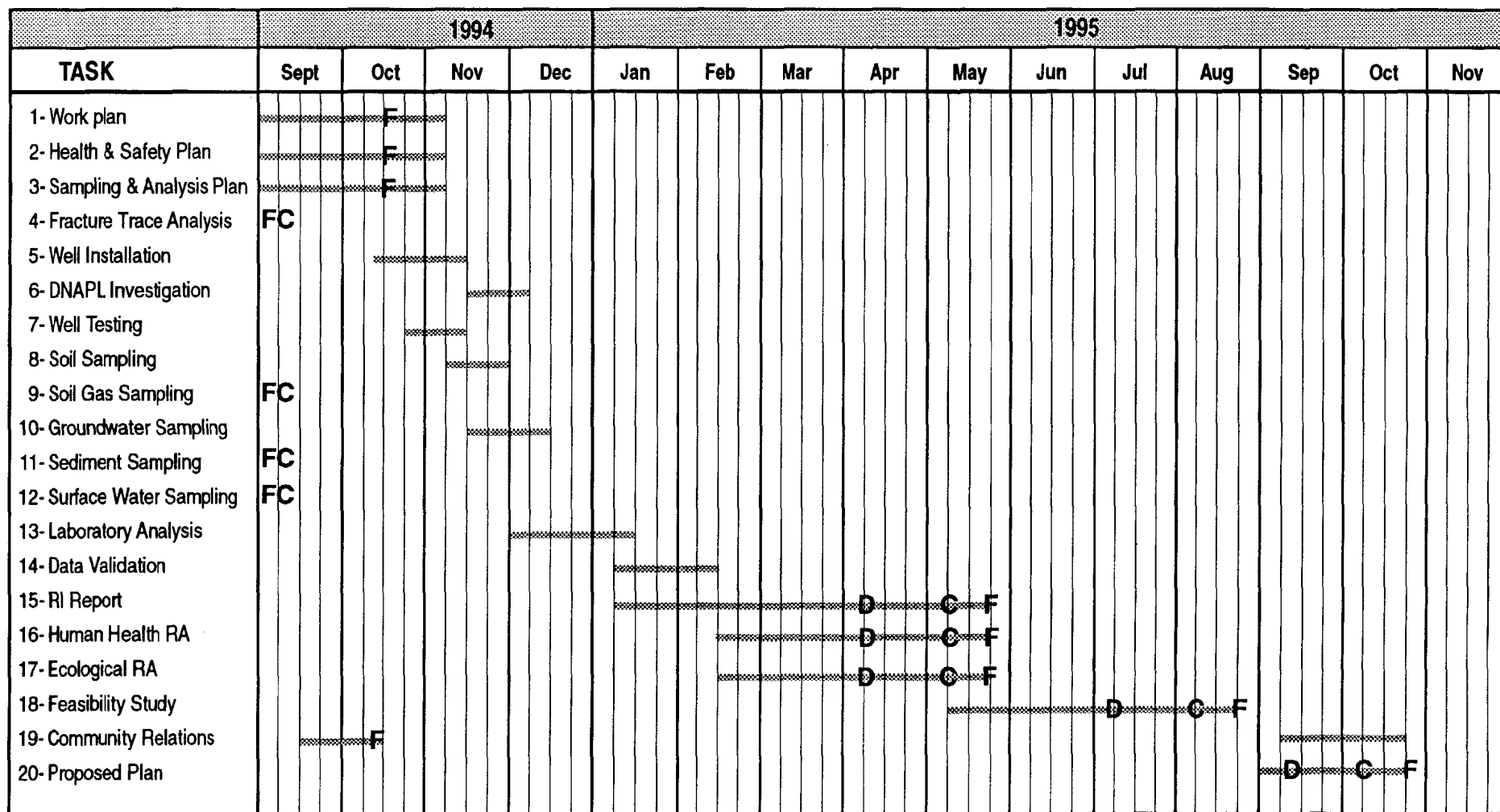
One proposed plan will be developed for Site 1 and submitted as a separate document. The document will include a summary of the focused RI/FS report, as it pertains to Site 1, and will include the following sections: Introduction, Summary of Remedial Investigation, Summary of Baseline Risk Assessment, Summary of Feasibility Study, Preferred Alternative, and an Engineer's Cost Estimate. The proposed plan will include the evaluation of the adverse effects of the proposed remedial action (Preferred Alternative) and develop mitigative measures for remediation.

Section 6

Project Schedule

Figure 6-1 presents the schedule anticipated to complete tasks 1 through 20 described in Section 5. Included in the schedule are periods set aside for EPA and State review. For scheduling purposes, a 30-day review period for all submittals was assumed. Longer review periods will result in an extended schedule.

WDCR814/017.WP5

**LEGEND**

- D- Submit Draft deliverable
- C- EPA & State submit review comments
- F- Submit final deliverable incorporating EPA & State Comments
- FC- Fieldwork complete

Figure 6-1
SCHEDULE FOR FOCUSED RI/FS AT SITE 1
Allegany Ballistics Laboratory

